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Farm Vehicles

Royal Show

WORLD CROPS

The International Journal of Agriculture

VOLUME 13, No. 8 AUGUST 1961

SEVIN Insecticide is now being widely used to control ticks on cattle. *For further details, see page* 290.

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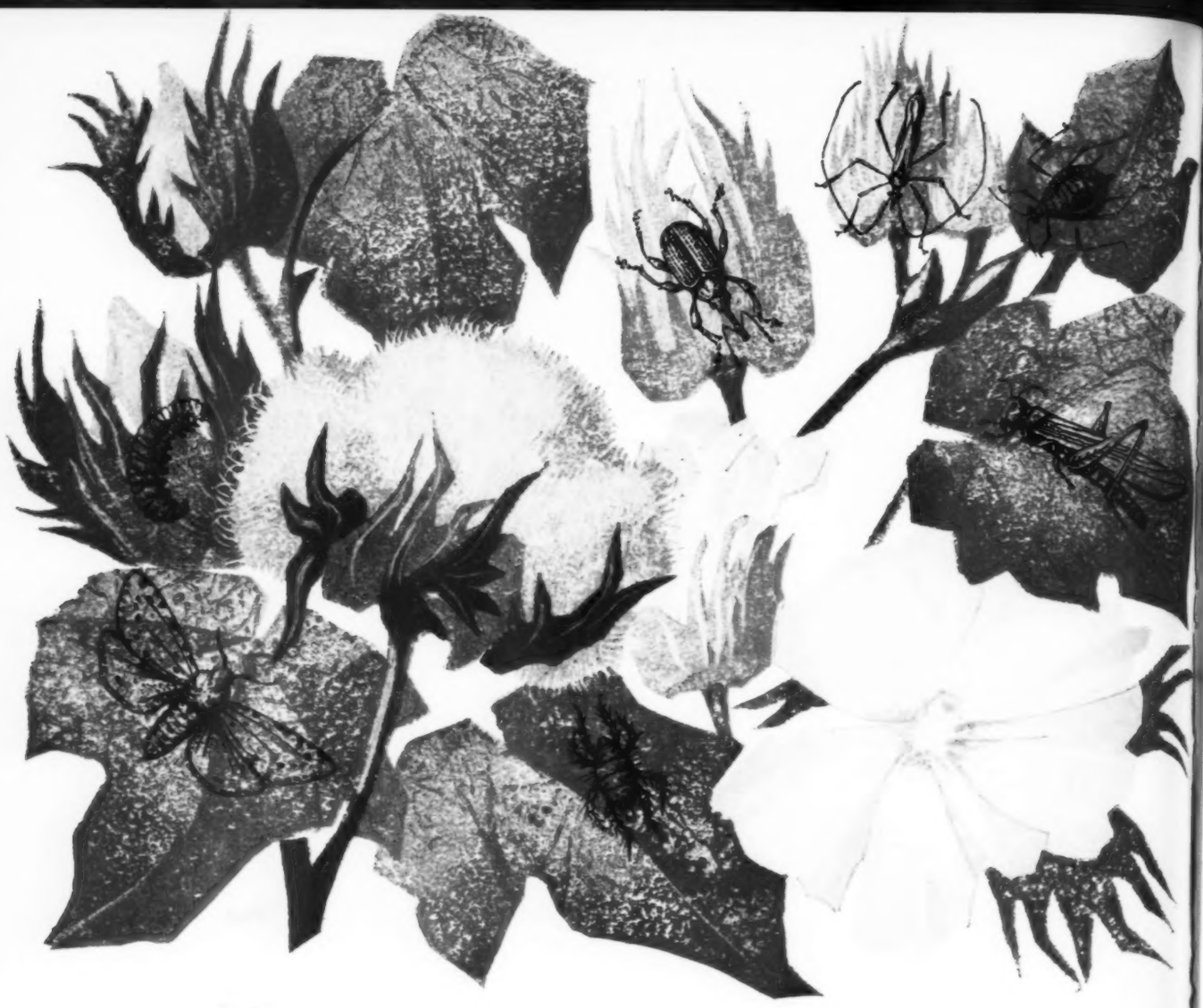

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WORLD CROPS

The International Journal of Agriculture

Vol. 13, No. 8 *August 1961*

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Agricultural Chemicals

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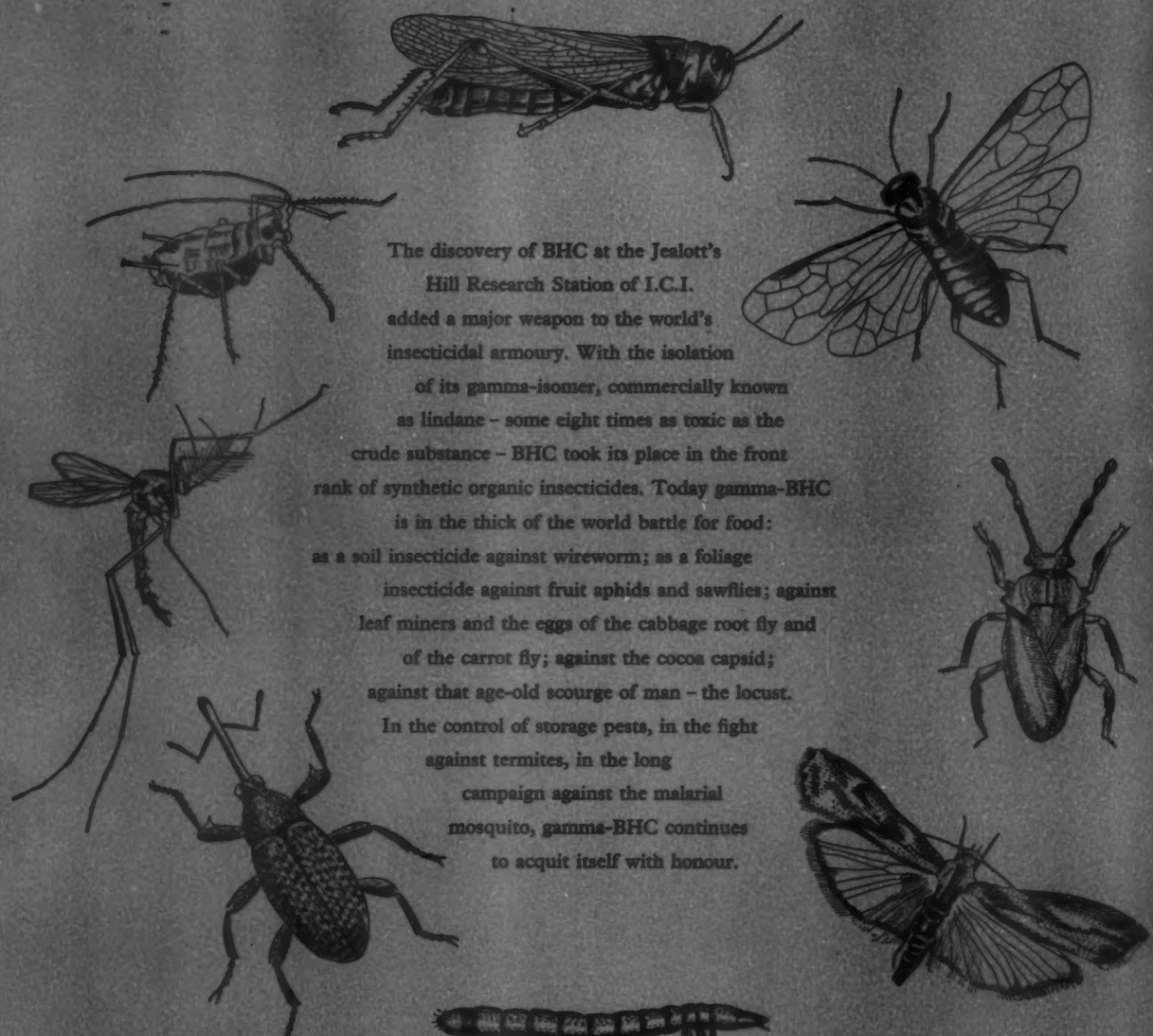

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Editorial Comment

Farm Vehicles

IMPROVEMENTS IN METHODS of transportation, together with recent advances in bulk handling and storage, have profoundly affected life and work on the farm in the more advanced countries and as ideas are spread they are playing an ever-increasing part in the development of new lands, the reclamation of 'badlands' and the improvement of agriculture generally.

Farmers need to be fully alive to the implications and to the possibility of exploring these aids to agriculture to compensate for losses in manpower, to increase productivity and to cheapen the cost of production per unit.

Thus, whereas a man can carry a box of produce on his shoulder, he can push three or four of them on a wheelbarrow and many times more with the aid of a lorry. Farm and estate vehicles, which include heavy lorries, light trucks, three-wheelers, small motorised units and fork-lift trucks, reduce the labour and discomfort of transporting material from one place to another and get the work done in far less time and more effectively.

Nevertheless, in many countries transportation is still being done by elephants and camels, bullocks and mules, horses, donkeys and even dogs, and in rough country, in the more remote areas, as head loads. But tractors, cross-country vehicles and motorised power units are largely replacing them and where there are roads the motor lorry is fast replacing the bullock cart, the hay wain and the beast of burden. In the granary, silo and flour mill, bag lifters and elevators, belt conveyors and suction tubes have done away with the dusty and laborious work of former times.

What does all this add up to? It means, of course that less organic manure is available, but cattle dung is today being regarded more of a nuisance as the knowledge of the soil and correct use of fertilisers grows. Most important of all, however, is the fact that less grazing land is required and more land becomes available for the production of arable and horticultural crops.

Tractors and Elephants

THANKS TO availability of foreign capital, Russian-made crawler tractors are beginning to replace the traditional buffalo and elephant in timber extraction, and bulldozers and other heavy road-making equipment are being used to open up Vietnam's rich tropical rain forests to the power saw.

As a result, the production of valuable hardwoods and firewood has virtually doubled since 1939, and output of bamboos, charcoal, palm leaves and lianas has more than doubled. The forests are, however, not being despoiled, for felling regulations and limits have been introduced, pest and disease control measures are being undertaken over large areas, dead wood, debris and logging remains are removed, forest protection committees have been set up at village level, fire control organisations are coming into being, reforestation is being carried out on the sandy coastal areas using pines, cunninghamia and eucalypts, and the 'rai' system of burning forests for shifting cultivation is being stopped.

North Vietnam's valuable timbers are already being exported as far afield as Czechoslovakia, and with sound forestry these exports will expand and diversify.

The Royal Show of 1961

THE ROYAL SHOW, held once again in the ancient university city of Cambridge, might well be claimed to be six shows in one, for, in addition to 4,309 head of livestock received from all parts of England, there was a first-class horse show with riders of international fame competing, the tractor-driving championship of England, a flower show, a demonstration of forestry and forest machinery and a show ground displaying and demonstrating modern farm machinery and equipment.

Looking Ahead Together

Producing food and other farm crops is today a complex scientific business, which demands proper planning if the highest possible yields are to be obtained at the lowest possible cost, with all the activities on the farm working at maximum efficiency; planning is also necessary to ensure that the final products are of top quality, that the prices are right for the market and that they are marketed in the best way. The essence of proper planning is 'looking ahead'.

The farmer and the market gardener need the best machinery and equipment and the best seeds and supplies they can get. In the 'bad old days' the farmer had to fend for himself and operate on his own restricted experience; nowadays there is the research worker to help him by producing better seeds and planting material, more effective fertiliser mixtures, more complete cattle foods and new medicines for farm use, and by analysing farm operations, otherwise known as time study.

Even so, these discoveries and findings are not always reported or presented in a form in which they can be applied by the farmer. They need to be further developed and explained. The agricultural advisory officer and the experimental station officer provide the bridge between research and development and the application

of the results on the farm; the adviser's job is to help the farmer and the farm worker. His job, in short, is to convert new ideas into practice.

The basic idea is that research, development, practice and presentation all combine to bring success to agriculture. The scientists who make and develop new discoveries, the advisers who pass on the new ideas, and the landowners, farmers and farm workers who use them work as a team for the success and prosperity of the farming industry, and so the theme of the U.K. Ministry of Agriculture, Fisheries and Food exhibit at this year's Royal was 'Looking Ahead Together'.

From Seed to Saw

The forestry exhibit at the Show took the form of a continuous demonstration of stages in the life of a tree from its start as a seed to its final presentation as cut timber, poles or paper pulp.

The latest methods of seed selection and collection were followed by examples of seedbed establishment, weeding, spraying and general maintenance. Young seedlings were being lifted, graded and packed and this was succeeded by a demonstration of planting methods to suit different conditions of soil and vegetation.

The thinning of young plantations is essential to the proper development of the final stand, so a variety of machines showed the cutting and extraction of the poles and their haulage to mobile sawbenches and mechanical bark peelers for conversion into fence posts, pit props and pulpwood.

From mature plantations the timber goes to the sawmills. The trees are felled and a mobile crane was seen moving trimmed logs from the stockpile to the receiving yard. Here they were cross-cut by a mechanical chain-saw and lifted by crane on to the processing ramp—a large bandsaw made the first cuts; a smaller saw cut the planks down further and a third saw made cross-cuts according to requirements.

The best timber is needed for building purposes, for making furniture and packing cases; inferior qualities are used for fencing, mining timber and for rough handling jobs. Softwoods are notoriously prone to rot and decay, but their resistance is greatly increased if they are impregnated with chemicals. A pressure impregnation plant was shown for treating timber to be used for fencing.

Modern English Usage

WE HAVE ALMOST passed through the age of abbreviations when such 'words' as C.-in-C., D.D.M.S., Q.M.G., UNO, FAO and C.S.I.R.O. meant something to somebody or could be interpreted to mean something, though we are sometimes at a loss to remember what the expressions UNICEF, OEEC and UNESCO really mean. Now we have arrived in an age of new words, such as 'caterpillar' track, meaning endless track; 'rotavation', meaning rotary cultivation, and 'atomising', by which we mean very fine spraying.

It is inevitable in an age of revolutionary progress that the older expressions and existing words are either inadequate or unsuitable to describe new agricultural machines and new methods, but patent names and descriptive trade names will only mean something to those to whom English is their first language and then only after years of common usage leading to their general adoption by farmers.

This year's Royal Show was characterised by a spate of new nouns, adjectives and verbs to describe or name new machines or processes, such as the 'Stayrite' electric motor, the 'Bulkveyor', the 'Varispreader', or the 'Multipull' hitch, meaning a weight-transfer hitch. The 'Balevator', the 'Cultograder', the 'Traxcavator', the 'Implematic' tractor, the 'Multitrac' plough and 'Fertispreading' are other examples. Almost inevitably, and in the fullness of time, the initial capital and the quotation marks are dropped and the word comes to be accepted as a new word in common usage, *e.g.* rotavation and rotavating stemming from the original description of a machine called the 'Rotavator'.

This is all very well in English-speaking countries, but what does it mean in France, Germany and Holland, where they only have orthodox English dictionaries to guide them, or in the newly self-governing countries, where few people are masters of the English language or where the English language is being actively suppressed in favour of the mother tongue of the people so that all men may have an equal chance in life or for purely nationalistic reasons.

Obviously new descriptive words require capitals and inverted commas until they have been sufficiently advertised and repeatedly advertised, as have the new words 'caterpillar', 'micronising', 'cage' wheels and 'rotavation' in the International Journal of Agriculture —WORLD CROPS. Then, and then only, will they come to be accepted as common, though, of course, *exclusive* words in export markets overseas.

Food, Water . . . and Air

THE THREE ESSENTIAL requirements of man are food, water and air. Hitherto we have given little attention to the need for air, as this would not at first sight appear to have any bearing whatever on the production of world crops. Nevertheless it has.

We were reminded of this at the winter meeting of the British Grassland Society, when Dr. V. A. Currie, of Rothamsted Experimental Station, said that the pore spaces in soil are occupied by air and water, both of which are, of course, essential for successful plant growth.

Plant roots and other organisms in soil respire, absorb oxygen from this soil air in competition with one another and give out carbon dioxide. To prevent plant growth from being checked, either by the lack

of the one or an excess of the other, it is necessary for the oxygen to be replaced and for the carbon dioxide to be removed; it is here that gaseous diffusion is important, for if a continuous system of air-filled pores exists between the respiring organisms in the soil and the atmosphere above the soil, then interchange of oxygen and carbon dioxide can take place by diffusion and anaerobic soil conditions are prevented from developing.

Recent work at Rothamsted, he said, has shown that diffusion is affected, not only by the amount of pores in the soil, but by their nature, their distribution and the way in which they hold water. Using this knowledge, together with assumed soil respiration rates, it is possible to predict the aeration pattern for a range of soil conditions, including depth of soil, oxygen requirement, diffusion coefficient and, perhaps of more practical importance to us, the effect of soil capping or of a hard pan below plough depth. The effect of crumb size on aeration is obviously important, but, as both respiration rate and internal crumb structure differ from soil to soil, no optimum crumb size can be specified.

Unbalanced Nutrition

Mens sana in corpore sano

While, on the one hand, Western, Northern and Central Europe has a nutrition problem—mainly due to eating too many fatty foods—some countries of Eastern and Southern Europe have problems of protein malnutrition and of vitamin and mineral deficiencies. The subject of balanced nutrition is really an essential subject in a balanced system of education.

Dr. M. Autret, Director of FAO's Nutrition Division, pointed out that over-nutrition was associated with over-weight, arteriosclerosis and degenerative heart diseases, while dental caries, rickets and anaemia were some of the symptoms of malnutrition.

This was the summing up of the nutrition situation in Europe at the 12th session of the European Commission on Agriculture, which met last May at the headquarters of FAO in Rome under the chairmanship of Mr. R. Braconnier, of France. To help governments tackle their nutritional problems, the Commission further recommended that advice should be given to governments on how to organise nutrition training in universities and colleges and national nutrition campaigns to educate the general public.

Africa and Irrigation

AS WE HAVE frequently pointed out, water for irrigation is bound to assume ever-increasing importance as world population increases. In particular, it is also one of the keys to the future productivity of Africa and in the struggle to maintain production, irrigation men will become of increasing importance in that vast, and in places arid, continent.

It is good news, therefore, that an international symposium entitled 'Africa and Irrigation' is being arranged by Wright Rain Ltd. at the end of August in Salisbury, Southern Rhodesia, which, we understand, is to be attended by leading authorities on the subject from Australia, the U.K. and U.S.A. Delegates from Rhodesia, Nyasaland, the Union of South Africa, Kenya, Tanganyika, Uganda, Mauritius and Mozambique have also accepted invitations.

The programme includes papers on the need for and methods of water collection and control, soil moisture and plant growth, and sprinkler and flood irrigation in relation to a variety of crops—cotton, sugar, citrus, tobacco, tea, coffee, forage plants, cereals and vegetables.

German Aid

THE GERMAN FEDERAL GOVERNMENT plans to increase assistance to developing countries substantially in 1961 and we learn that agriculture is to be one of the main fields where assistance will be given. Educational centres have been, or are to be, set up in many countries. The form they will take will be largely determined by the different agrarian structure, the population pressure, and educational standards of the countries concerned. There is a model farm, for example, at Tahir Ova in Turkey, which is to be used as a training centre for increasing agricultural efficiency and production.

'No sugar again!'

Model agricultural districts are being set up at Aliabad (Iran) and at Multan (Pakistan) to acquaint farmers with methods of managing holdings on a co-operative basis. Technical training centres are planned at Osorno (Chile) and at Rabat (Morocco), and there is to be an agricultural experiment station at Houdeiba in Northern Sudan. In forestry, institutes are projected for Bogor (Java, Indonesia) and Monrovia (Liberia).

Crop protection centres are already being established at Khartoum (Sudan), Teheran (Iran) and Damascus (Syria), and others are planned for Jordan and Libya. A mobile veterinary clinic is at work in Tunisia, while others will soon start work in Guinea, Libya and Mali.

All this is good and it is to be hoped that it will meet with a proper response in the countries concerned and that these 'emerging' countries will continue to advance along the road of true progress.

This Month's Cover Picture

'Sevin' insecticide, Union Carbide Corporation's new broad-spectrum insecticide, has effectively controlled ticks on cattle in tests conducted in Argentina, Brazil and the Union of South Africa. The tests showed that when applied as a dip or spray it was not readily absorbed through the skin, nor did it contaminate the meat when it was used at the rates recommended.

Even ticks that had become resistant to other chemicals were controlled with this new carbamate insecticide. This is a development of great importance to cattle producers in areas where ticks have become difficult to kill with certain chlorinated hydrocarbon and phosphate-type insecticides. Some of these resistant strains are carriers of cattle diseases and it is essential they should be destroyed.

The same insecticide is also being used on a wide variety of crops, including grain and forage. In recent test work in the U.S.A., dairy and meat animals have been fed on crops that have been sprayed at recommended rates up to seven days before harvest without any detectable contamination of the milk or meat. Even when dairy cows were given measured amounts of 'Sevin' insecticide in their daily feed the milk still remained free of the insecticide.

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Advertiser's announcement

Money from Muck

DIFFERENCES IN SWISS AND BRITISH methods in the practice of organic irrigation were noted by a party of British farmers who were flown over on a tour organised jointly by Farrows, of Spalding, and Bucher-Guyer, the Swiss manufacturers of irrigation pumps.

Conservation and use of liquid manure has been an unquestioned practice in Swiss agriculture for over 200 years; today mechanisation is being applied increasingly.

One-fifth of all farms there have some kind of pumping equipment for liquid manure and about one in 10 has a piston pump and irrigation pipeline. There is usually an oblong cesspit equipped with large agitators and a considerable length of permanent underground pipeline leading to hydrants in the fields.

Because organic irrigation is a basic farm practice in Switzerland, the cesspits are built in as integral features of the large but simple one-unit buildings.

The use of inorganic fertiliser is nevertheless still high on these farms for, as Professor R. Koblet of the Federal Institute of Technology pointed out, any deficiency of plant nutrients in the soil is also in the pasture and so must also be reflected in the nutrient content of the dung of the cattle. Such deficiency has naturally to be made up from the fertiliser bag along with loss of phosphate associated with the milk and meat consumed by man.

Challenge

Aid is being freely given through various agencies to the newly self-governing territories, but it has truly been said that it is more blessed to give than to receive. It is incumbent, therefore, on those who receive aid and advice to pass on the benefits of their experience to others so that they, too, may profit from the successes and even learn from the failures or disappointments.

It is in this sense that we invite those who are in a position to write authoritative articles on new agricultural developments in their own countries or on things which they have learned from their visits to other countries to become contributors to WORLD CROPS. Our readers all over the world want to learn about the introduction of new methods and modern machines—whether successful or otherwise, and in the event of failure the reason why.

The articles should be technical rather than scientific, *i.e.* they should deal with the practices of planting and farming rather than the theory. So we issue the challenge—Will the newly self-governing countries carry on the traditions of the past and make their contribution towards the advancement of world agriculture?

Left: *Malaya. Ploughing a dry paddy field.* Right: *Uganda. Inter-row cultivation using small weak oxen*

FROM MAN POWER TO MACHINES—1

Mechanisation for Small Farms in Under-developed Countries

J. C. HAWKINS,* B.SC., N.D.A.

With the big population increases in the under-developed countries the demand for food grows and subsistence agriculture, using simple hand tools, can no longer be tolerated. The problem is what to recommend instead.

TODAY every under-developed country is concerned with the problem of how to introduce mechanisation into an agriculture based on a large number of smallholdings. The individual farmers have a few acres, which may be made up of several separate little fields scattered over the district; they have no capital and no knowledge of tractors and agricultural machinery.

Farming by hand methods—usually with poor varieties and without fertilisers, without pest and disease control or soil conservation—their output, and hence their income, is pitifully low. Their life and that of their family is hard and hopeless and will remain so unless something positive is done to bring them the benefits of modern techniques, including mechanisation. The ability to buy and use machinery wisely can rarely arise spontaneously: it must be introduced from outside and the difficulty is to find the most efficient way of doing this.

The problem is not new. It has long been recognised and tackled by governments, agricultural departments, development corporations and similar bodies in many countries. Enough attempts to introduce mechanisation into established agriculture, based on very small farms, have now been made to allow some broad conclusions to be drawn about the different ways of doing it.

In general, the three approaches that have been used are based on animals, on small two-wheeled or market garden tractors and on the standard wheel tractors of Western agriculture. These will be considered in turn: the mechanisation of the agriculture of new land —reclaimed or cleared for settlement —is a different and often an easier problem and will be considered separately.

Draught animals

Animal-drawn equipment seems at first to be the logical starting point for mechanisation in countries where everything is now done by hand. It was, after all, the stage through which the more highly-developed countries passed on their way from hand tools to the tractor. Nowadays, however, animals are rarely attractive as a source of power to small farmers, however backward, if they have seen tractors at work; organisations fostering the use of draught animals may well find themselves out of date in a few years' time.

The peasants' or smallholders' disinclination to adopt animal power is

* Head of Soil Department, National Institute of Agricultural Engineering.

Northern Nigeria: Hard work by hand methods. Harvesting groundnuts

not entirely based on the natural human desire to have the latest and best, although it often plays a part. In many cases there are one or more of the following practical reasons against the use of draught animals:

The most important claim that is usually made for animals is that they are so cheap that they are within the reach of even the smallest farmers. This may, however, be true only when they already own suitable livestock. The cost of a team of oxen in Uganda has recently been put at £70 without harness or implements and few really small farmers could hope to find such a sum.

In densely populated countries like the West Indian Islands there is no possibility of introducing draught animals. Land is so scarce that none can be spared from food or cash crops to support them. In other places animals cannot be considered because of disease. Even where there is ample land for grazing and fodder crops and where cattle are kept at the present time, it is not always easy to convince their owners that they could be used as a source of power.

Cattle, for example, are usually so small and weak that a pair of oxen would be capable of little useful work, and there is no tradition of breaking and handling them properly. It would, therefore, need considerable effort over a long period to improve the stock and build up the experience required. Further, when animals are kept for their meat and milk they produce less of these things if they are made to work as well and draught animals are often not readily accepted in a dowry.

Finally, it is by no means certain that even a good team of animals can carry out all the cultivations that may be desirable on many tropical soils. Land may be so dry and so hard at the time when it should be broken for the next crop that only a wheel tractor is capable of doing the job. Even when cultivations can be done by animals their rate of work may be lower than is needed to ensure that a new crop can be planted soon enough after the preceding one for the best results or to make the maximum use of rains of short duration.

Two-wheeled tractors

Small two-wheeled or walking tractors of the type developed for horticulture in temperate climates have frequently been suggested as a suitable source of power for small farmers in the tropics. They appear attractive because they have been designed for the size of holdings which present the most serious current problem in underdeveloped countries.

They are not, however, a cheap source of power because the price per horse-power rises steeply as tractors become smaller. The price per horse-power of a small two-wheeled tractor is about twice that of the standard 30/40-h.p. four-wheeled model. Running costs, too, follow much the same pattern; while depreciation and maintenance costs are lower, they are not proportionately so, and labour and fuel costs per acre are considerably higher.

The fact remains, however, that there are some small farmers who might be able to find the £100-£200

Tanganyika: Typical root unearthed during the cultivation of cleared land

Left: *Northern Nigeria. Clearing bush slowly the hard way—by hand.* Right: *Malaya. The problem of uncleared roots and stumps left after hand clearing of jungle*

required for a small two-wheeled tractor and its equipment when there could be no possibility of them having the £700-£900 needed for a four-wheeled tractor and its mounted implements.

While, perhaps, not out of the question on cost, current two-wheeled tractors cannot be considered to be suitable for other reasons. The handling of most types is very hard work and it needs a strong and skilful man to work them for an eight-hour day in colder climates. The usually weaker and less skilled operator in the tropics can manage little more than three or four hours of continuous work—after that it has often been noted that the tractor breaks down.

The small air-cooled engines fitted to practically all two-wheeled tractors need regular and careful maintenance if they are to have an economic life and it is rarely possible to ensure this in primitive agriculture. Designed originally for work in countries where intensive farming has been practised for many years, such small tractors are not always capable of carrying out primary cultivations in the tropics, except possibly in wet paddy fields.

Discounting any possible loss of power because of altitude, few of even the largest and most expensive of them are capable of making an impression on a hard, dry soil and if the going is difficult because of uncleared roots, rocks, stumps and anthills they are out of the question. Their rate of work is also low and their use may delay planting beyond the optimum date in a double-cropping area in the same way as with hand implements or animal-drawn equipment.

It is often claimed, however, that two-wheeled tractors are justifiable for light and inter-row cultivations. This may be true on larger holdings, but it is of little help to the small man who so badly needs some way of mechanising the heavy work.

Four-wheeled tractors

There can be little argument that the modern four-wheeled pneumatic-tyred tractor of 30-40 h.p. provides, with its associated equipment, the most efficient source of power for most of the world's agriculture. The difficulty is that its cost is beyond the wildest dreams of those who most need help from mechanisation. The problem, therefore, becomes one of finding the best way of making such equipment available to the small farmer at an economic cost.

In highly-developed countries there has long been a good supply of sound and cheap second-hand tractors from large farmers, which gave smaller men a chance to make a start with mechanisation at a price that they could afford.† Such a supply does not exist in the early years of mechanisation of an under-developed country and, if and when second-hand tractors do become available, they are usually little more than so much scrap.

There is the possibility, however, that second-hand tractors might be exported from those countries where they have become an embarrassment to agents, to under-developed countries. This supply might help the larger smallholders, but would still be of little interest to the tens of thousands of really small men.

Simple austerity tractor

Another solution often suggested is the development of a simpler and hence cheaper 'austerity' version of the standard tractor, designed specially for under-developed countries. On close examination this idea becomes very much less attractive.

The tractor cannot be too small and light because it must be capable of providing a minimum pull of about 1,000 lb. under all reasonable conditions if it is to handle a single-furrow plough. It must also be robust enough to withstand rough usage on land not completely cleared. If it is to work efficiently in the small fields of peasant agriculture, it must be equipped with mounted implements and hence must have a lift. Wheel grip will be improved without built-in weight if the lift incorporates a depth control mechanism and the implements will be cheaper with no depth wheels. Provision for some form of belt pulley is necessary, too, in order to provide power for pumps and stationary machinery like mills, maize shellers, groundnut decorticators and paddy threshers, so badly needed by small farmers everywhere.

A tractor incorporating all these components, however, becomes just a

† It is the usual practice for two-or three-year-old tractors to be accepted in part payment for a new tractor. These are reconditioned and sold as second-hand machines.

Tanganyika: Animals and small tractors make little impression on the baked hard soils in the tropics

smaller version of current standard models and so would be little cheaper. Further, if it were considered possible to forego these refinements in the interests of a low first cost, it would be a very brave manufacturer who would undertake the capital cost of putting down the modern automated plant required to manufacture such tractors in the quantities necessary to make sure that the price was low in comparison with that of existing models.

If all the foregoing is accepted, the problem of bringing the benefits of mechanisation to the smallest farmer is narrowed down to that of finding the right way of making the work of standard wheel tractors available to him efficiently and at a price that he can afford. This has been attempted in under-developed countries in many different ways, but they can, for the purpose of discussion here, be grouped under three headings—government hire service, co-operative ownership and contracting.

(To be continued)

Collapsible Trees

An artificial 'tree' as an aid to the teaching of pruning methods has been used with some success in Holland.

Because of the importance of pruning and the formation of young trees in fruit cultivation, particular attention is devoted to these activities in teaching and advisory work. Teaching by drawings is not always satisfactory and the method of using an actual tree raises the problem of finding an appropriately shaped tree for each demonstration; also faulty pruning is difficult to rectify when using a living tree.

The material used in the construction of the artificial tree resembles living material, stands up to continual use and is flexible, according to a report by the European Productivity Agency. The 'tree' is collapsible and fits into a specially designed box for transportation and so that the branches and shoots can be removed and replaced during demonstrations.

Further details about the method may be obtained from the Department of Visual Aids, Ministry of Agriculture, Fisheries and Food, Afdeling Voorlichtingsmiddelen, Ministerie van Landbouw, The Hague, Holland.

Leonard Hill Director to visit U.S.A.

W. G. Norris, Editorial Director of the Leonard Hill Group of Publications* will visit New York and Washington from 2-20 October. He looks forward to meeting readers of and advertisers in WORLD CROPS and invites correspondence to this end.

His address is Leonard Hill House, Eden Street, London, N.W.1

*Automation Progress, Building Materials, Chemical and Process Engineering, Conferences and Exhibitions, Corrosion Technology, Dairy Engineering, Fibres and Plastics, Food Manufacture, Manufacturing Chemist, Paint Manufacture, Petroleum, Public Works and Muck Shifter, World Crops.

More Crops for Ghana

A survey of the Lower Volta Plain in Ghana is being made to determine whether the right conditions exist there for large-scale crop growing under irrigation. The project, which was begun in April 1960, is investigating topographic, soil, agronomic and other conditions in the area and will assess the cost of irrigation and drainage works. The purpose of the survey is to investigate the prospects of creating new agricultural enterprises.

Mr. A. de Vajda, of the Land and Water Development Division of FAO, is in charge of the project which is being carried out on behalf of the UN Special Fund for Economic Development. It was initiated by the Ghana Government, which is providing the equivalent of $170,000, supporting staff, labour and equipment as its contribution. The UN's Special Fund is providing a further $305,000.

The Lower Volta Plain, which lies 50-100 miles north-east of Accra, is inundated every year by the rains and also by the floods of the Volta river, which infiltrate up the creeks and submerge large areas of land behind the banks. It is believed that these creeks can be dammed and, with the help of irrigation and drainage, fertile soil can be made available for agriculture.

On his recent return from Ghana, Mr. de Vajda reported that the soil survey will be completed this year and that the original three-year project will probably be telescoped into 27-28 months.

Kenya. Tea on an African smallholding near Ragati

Cash Crops for Smallholders

E. S. CLAYTON,* PH.D., B.SC.

THE prices of many export products of tropical agriculture are usually sensitive to changes in world conditions of supply and demand. This has been a constant problem of primary producing countries. When, therefore, a blueprint of agrarian development was drawn up for Kenya in 1954—called the Swynnerton Plan—the author of this plan sought to base the raising of rural incomes on as wide a range of cash crops as was ecologically feasible, instead of concentrating on the most profitable of these crops. The potentially greater return from these was considered less desirable than a more broadly-based expansion which, though less lucrative, was thought less risky.

In the event this decision was probably justified. Since 1955 there has been a very uncertain market for pyrethrum and pineapples, and the world price of coffee, for all grades, has steadily declined; tea prices alone have been fairly stable. Although the inclusion of tea in the development plan was to broaden its base and to provide an ecological alternative to pyrethrum (tea grows from 5,000-8,000 ft. and requires 45-80 in. of annual rainfall), the decision was not without risk because tea is not a 'natural' peasant crop. In India and Ceylon, for example, efforts to establish a tea industry based on a large number of peasant growers had indeed met with failure.

Economics of tea

Tea is, after all, a relatively costly crop to grow. The bushes reach maturity five years after the planting of stumps and the establishment cost of 1 acre (without allowing anything for labour and fertiliser) is approximately as follows:

	£
3,500 tea stumps at 24 cents each	43·5
Loss of crops for five years	125.0
Total ..	168.5

By contrast, an acre of pyrethrum costs only £34 to establish—17,000 splits at 4 cents each—although it must be replanted every four years. On the other hand, the net returns from tea (excluding labour costs) are around £100 an acre at present prices, as against about £60 an acre from pyrethrum.

In 1950, small plots of tea were planted in the Nyeri area and nursery development was started. In 1952 the Agricultural Department was satisfied, from experience on these trial plots, that tea could be grown successfully by African smallholders. These experiments, of course, threw no light on the other major phases of tea production—nursery work, collecting the crop and processing it. It was for this reason that there was caution in planning for the growth of the tea industry.

Target acreages were set as follows:

Year	*Acres*
1953 ..	35
1958 ..	2,000
1963 ..	6,000
1968 ..	12,000

* Wye College, University of London

The actual achievements were:

Year	*Acres*
1953 ..	37
1954 ..	41
1955 ..	206
1956 ..	365
1957 ..	543
1958 ..	817
1959 ..	1,541

In 1959, 4,526 growers were involved and they produced tea worth £29,254. This is modest enough when compared with the Kenya Africans' coffee crop worth about £2 million, but most of the tea bushes have yet to reach maturity. Actual development has fallen short of planned expansion largely because there was a shortage of planting material (tea stumps) and this arose from a capital shortage which restricted the required nursery expansion. This is now being rectified and a new, accelerated cash-crop development programme should make the target acreages easily attainable.

Weeding in the tea nurseries. Note the shading of young plants with the shrubby leguminous cover, Tephrosia candida

Collection and processing

Of course, the establishment of a successful tea industry depends on maintaining a balance between growing and processing capacity. After the nursery and growing phase there are the difficult problems concerned with the collection of green leaf from numerous scattered growers and the erection of a costly factory. In Kenya each factory is designed to serve 1,200 acres of mature tea and is situated no more than 10 miles from each of the collecting centres.

Transport of the leaf from the collecting centres to the factory calls for special measures. The picked crop is delivered by the grower to the collecting centre by head porterage. Thereafter, transport to the factory door should be done without undue shaking and within six hours of picking if the leaf is not to deteriorate.

To meet these requirements has necessitated the strategic siting of collecting centres, the building of feeder roads and a network of country lanes, and the construction of special lorries fitted with fans which start off the withering process during the journey. After a process of trial and error and after several failures the collection problem seems to have been solved satisfactorily.

The factories also have to be strategically placed. The peasant growers are able to achieve mature tea yields of 1,000 lb. of made tea an acre, *i.e.* about 4,500 lb. of green leaf; the optimal factory throughput is, therefore, at least 1.2 million lb. of made tea per annum.

To date one factory has been built at Ragati on the slopes of Mt. Kenya. It has cost about £100,000, being financed by Colonial Development Corporation funds, and it started operation in 1957. From an economic point of view the success of this phase depends very much on the factory achieving its optimal annual throughput, but since processing commenced this factory has fallen well short of this. Indeed, after four years of operation, throughput in 1960-61 was only 410,000 lb. of made tea, or 34% of the optimal scale of operation.

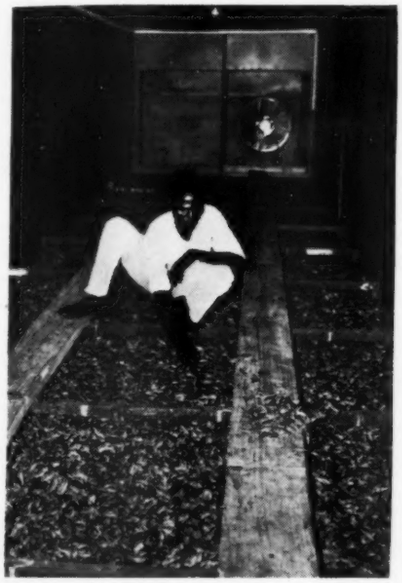
High processing costs

The unit costs of processing this relatively small throughput must have been high and this situation is likely to continue for a number of years. These high processing costs will have

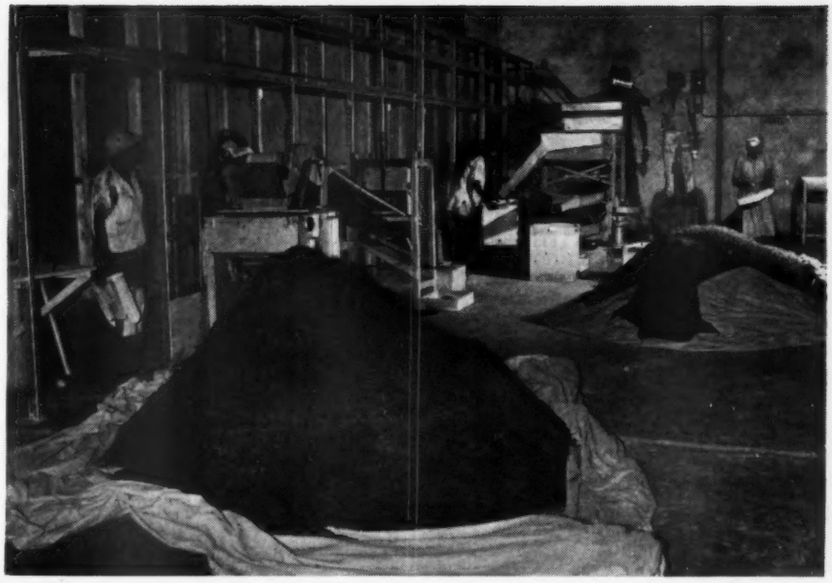
Kikuyu smallholders bring their green leaf to the buying centre, where it is weighed

been reflected in correspondingly low pay-out prices to growers (since no subsidies are involved), but these were no doubt mitigated by the fact that Ragati processed tea has been of very high quality.

The effect of a relatively low pay-out price could be serious. It might make some other cash crop—for example, pyrethrum—a more attractive alternative. If this occurred, the planned tea acreage in relation to which the factory is geared (1,200 acres), and hence the optimal throughput, might become impossible to achieve. Then there are always the possibilities of a fluctuating output due to weather variation and declining cultural standards or the world price of tea may fall. All of these dangers would clearly jeopardise the successful establishment of a peasant tea industry.



A new withering process in use at the Ragati tea factory



Sorting and grading made tea at Ragati

Need for capital

The problem of finding capital for nursery development and the erection of factories is, of course, paramount. Some economy is being effected in this direction by arranging for smallholders near the non-African tea estates to sell their leaf to the estate factories. However, there is a limit to this and a programme of factory building—six in the immediate future—has to be undertaken.

The Government cannot, of course, finance this programme alone. A suggestion that private enterprise, in the form of some large tea companies, and the Colonial Development Corporation might enter into partnership with the Government to erect factories has met with a gratifying response. Already one factory in Meru is going up on this basis and will be in operation by 1964.

To safeguard the private companies against the risks of investing in a new, untried industry the factories are to be granted zonal monopoly rights, *i.e.* each factory will be allocated an area from which leaf will have to be supplied by smallholders. The price paid for green leaf will be negotiated between the company and the Government. An agreement has also been reached which insures the companies against throughputs below a certain level when these are due to factors other than weather.

Co-operation not yet possible

It is unfortunate that the only way of getting investment funds for factory development is by the creation of private processing monopolies. It would have been so much better if the factories could have been run as co-operatives like the coffee-pulping factories, where growers could participate in the framing of factory policy and control would be entirely African, but tea processing is on such a large scale and is so relatively complicated that at this stage the co-operative has proved impracticable. In consequence the grower has so far no voice in processing policy, including the important subject of pay-out prices, and control is in non-African hands.

In order to remedy this serious shortcoming a proposal has been made whereby tea growers, through an association of smallholders, could acquire a proportion of the shareholding of the factory company in order to give them a greater interest in the production and stability of the enterprise. But the scheme has not yet been put into practice, nor are the details known, so its value cannot be assessed.

Economic Botany

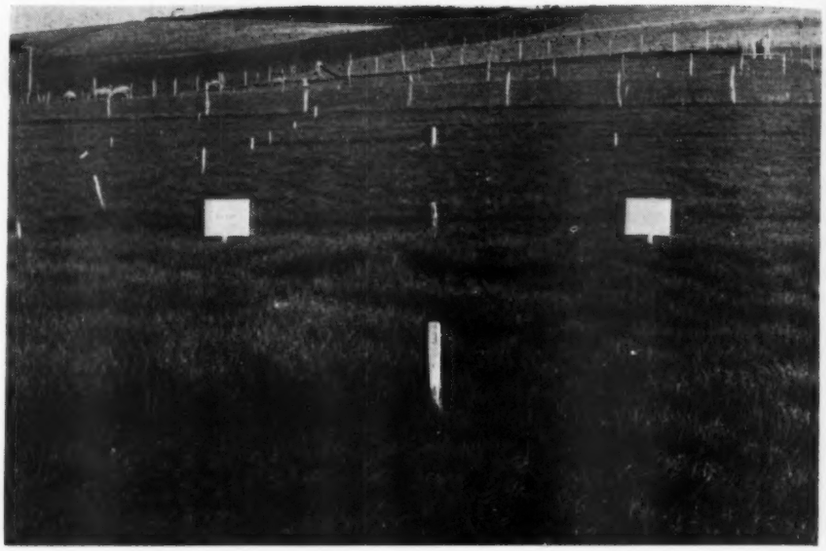
The U.S. Society for Economic Botany is an international scientific organisation for the promotion of the study of plants useful to man. Annual meetings and technical conferences are arranged and *Economic Botany*—the official journal of the Society—is available to members.

Nearly all branches of science—anthropology, pharmacology, geography, agriculture, chemistry, physics and the botanical sciences—are represented in its membership, but the essential requirement is a genuine interest in the study of the past, present or future uses of plants to man.

Enquiries should be addressed to the Treasurer, Richard M. Klein, New York Botanical Garden, Bronx Park, New York 58, N.Y. (U.S.A.).

Grasslands of Tomorrow

This is a WORLD CROPS digest of the Presidential Address given by Dr. William Davies at the winter meeting of the British Grassland Society.



New variety of perennial ryegrass which gives abundant autumn growth

FROM its earliest days, the British Grassland Society has given prominence to the practical problems of pasture evaluation and of animal production from grass and grass products, so as to obtain a more accurate assessment of the role played by grassland plants as a diet for cattle and sheep.

Recently the British Grassland Society, in co-operation with the Milk Marketing Board, the Surrey and Sussex County Grassland Societies and the Grassland Research Institute, has taken this question a step further and has undertaken a programme of developmental research to devise a simple system of grassland recording for the farmer.

Grass as a food

It will also be necessary to evaluate grass as a food and to do this with precision, using the saleable animal product as the yardstick of worth. The potentials of climate, soil and of physical input (*e.g.* fertilisers) must be known and put to full use within a biological environment embracing plant, animal and also the human element.

The basic approach of the livestock farmer to the use of grass as animal feed will rest upon the comparative cheapness with which grass can be grown. As feed it is least costly if directly grazed with no harvesting and storage costs. However, because of the seasonal nature of plant growth, there will always be periods of shortage or periods of excess growth and problems of grass conservation must be faced.

This, however, does not reduce the need to minimise the influence of dry weather in summer or of low temperature and/or low light intensity during winter. Therefore extending the number of weeks during which grassland makes active growth within the calendar year must be one of the major problems.

Nevertheless, quality of pasture is probably the most urgent problem insofar as out-wintered animals are concerned, although in most situations in the lowlands the quantity of pasture is also limited in winter and during the driest weather of summer.

Indigenous species and varieties provide reasonably adequate feed of good quality and thus cover the summer period very well, but improved techniques and the use of the new varieties already make it possible in the U.K. for the grazing season to be extended from March to November, a total of some 30-35 weeks. To extend it still further new varieties must be found among exotic grasses. Already it is known that certain Mediterranean forms of tall fescue, cocksfoot and other grasses from the sub-tropics show considerable potential for growth during winter.

Use of fertilisers

It is now accepted that to make the most of grassland it is necessary to use lime, phosphate and potash in adequate amounts. There is less agreement with regard to nitrogen. 'Bag' nitrogen is available in quantities as never before, but there is still controversy as to whether it is better to use more fertiliser nitrogen or to foster the legumes and thereby obtain the nitrogen from biological sources.

This is basically a matter of economics and it would seem that within the extensive systems under which most British grassland is farmed today there is a strong case for relying on the clover rather than on bag nitrogen. However, the use of additional nitrogen for specific purposes, such as for production of grass in early spring and late autumn, is usually necessary. On the small livestock farm, however, grass production must be more intensive. In this case fertiliser has to provide the major source of nitrogen and the legume nitrogen becomes more or less incidental.

Mineral deficiencies

Trace element deficiencies have been recorded in Britain, but the symptoms are exhibited more often by the animal than by the pasture. For example, copper deficiency in the animal can probably be related to diet, and grass generally as a feed tends to be short of magnesium. There may also be other minerals in short supply inhibiting plant growth as well as animal performance. The evidence as regards the place of the trace elements in our normal fertiliser programmes, however, is still fragmentary, but there

is enough to show that this line of enquiry might prove fruitful, notably perhaps in moorland reclamation.

Mineral excesses

Situations also arise where an excess of certain minerals is suggested. A classic example in this country is molybdenum excess on the 'teart' pastures of Somerset. Excess of potassium in herbage causes ill health in the animal without showing obvious symptoms in the plant. Grasses and legumes take up potash at 'luxury' levels seemingly without adversely affecting the plant, but causing dysfunction in the grazing animal. This may be toxicity or the consequence of an imbalance of minerals (calcium, magnesium and sodium). The practical point is that the intensive grassland farmer may have to guard against excessive use of potash.

Nitrogen in excess?

The dietary value of very heavily nitrogened grass is also in question both on the score of palatability and nutritive value. The nitrogen content of green leaves is increased by heavy dressings of fertiliser nitrogen. The fact that most herbage grazed during the spring and summer in Britain contains amounts of nitrogen in excess of animal requirements suggests that the dietary value of herbage of low, medium and very high nitrogen content should be critically tested.

Much of the nitrogen in green leaves is likely to be in immature forms—in process of elaboration into the proteins of mature plant tissues. Some of this nitrogen is in the leaf as nitrate and this can accumulate in leaves if the uptake of nitrogen by the roots is at luxury levels. Dysfunction and death does occur in animals grazing on herbage of this type.

New early fodder cocksfoot on right compared with early commercial strains

Grassland management

Good grassland management is the association of plant, animal and soil in such a manner that high production of grass is attained on a continuing basis, *i.e.* within a single season and in successive years. This should be accompanied by such quality of the grass diet as to be adequate at each grazing to cater fully for the needs of the thrifty animal of high potential production.

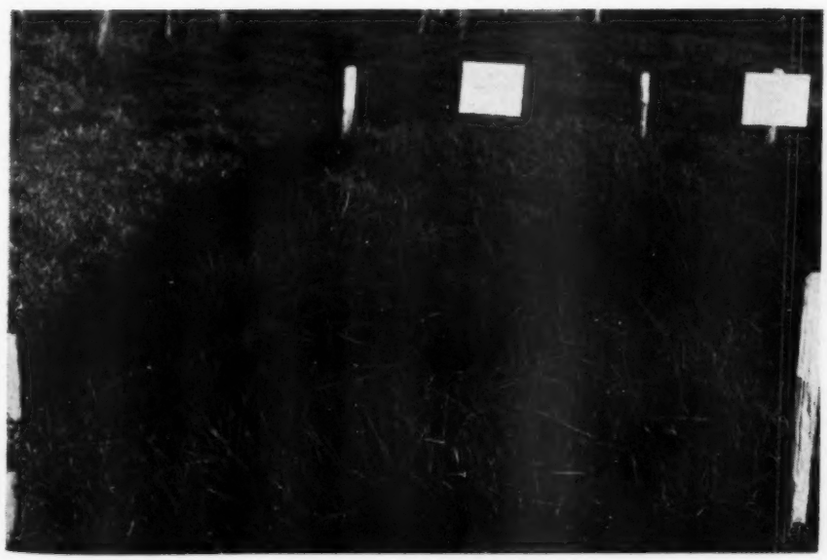
Thus an integral part of good management is the improvement in soil potential and in its crop-yielding capacity, considering the rotation as a whole. Good grassland management leads to high yields of herbage and high values of animal output from grass and in turn enhances the fertility of the soil.

Most herbage plants, when in active growth, contain minerals in quantities adequate for the normal needs of the grazing animal. There may be exceptions, such as cobalt or copper. Some minerals may be at excessively high levels in herbage, again generally as in the case of nitrogen, or seasonally as in the case of potash.

Energy value

Grass as we know it in Britain has an energy value usually adequate for maintenance and for some production in the meat and milk animal, but may fall short in energy requirements of the milk cow at its peak of production. The sugars and other water-soluble constituents of herbage have a high energy value and the proportion of these constituents might be significantly increased.

It seems that ryegrass is richer than cocksfoot in soluble sugars and the digestibility of herbage is higher when young than when old. Actively growing herbage may be of higher digestibility and its content of soluble sugars higher during sunny weather than under cloudy or dull conditions. This may explain in part why grazing animals thrive better when the summer is dry and sunny than they do in wet and comparatively sunless seasons.



Winter growth in diploid cocksfoot derived from plants collected in Portugal

Crop losses

There are serious losses incurred from the time the crop is grown to when it is utilised by the animal. These losses are much greater than is commonly recognised, and it may well be that only about one-third of the energy produced by grassland plants is, in fact, used by the grazing animal. It is important, therefore, to know just when and where these losses occur and prevent them.

To begin with, there is much wastage on normally grazed pasture land, wastage due to insufficient grazing, accumulation of bad patches, including those associated with animal excreta, and also due to leaf fall both at periods of rapid growth and during times when growth is allowed to accumulate, as in hay, silage and foggage production.

There are also considerable losses involved in the making of hay and silage. Prof. S. J. Watson* has indicated in his recent book that the average losses in grass silages made experimentally are of the order of one-fifth dry matter, one-third starch equivalent and three-quarters of the digestible crude protein. These data are based on experimental material where care would usually be taken to reduce the losses; it is likely that under normal farm conditions the wastage is very much greater.

Some of this wastage, both during grazing and in the processes of conservation, may be unavoidable, but we need to re-examine the whole problem, for the present losses are of such magnitude that they cannot be tolerated within an efficient system of grassland utilisation.

Under-developed lands

An important section of British grasslands completely under-developed is to be found in the hilly areas of Britain; this represents some 46% of the total grassland area in the U.K. In addition, there is much marginal land on the valley slopes, some of which has been reclaimed since 1945, but the extensive plateaux at elevations between 1,000 ft. and 1,500 ft. have not yet been tackled on a national scale.

The problem must be tackled nationally, for it is only partly a grassland and animal problem; it is also a forestry problem, a matter of making the hill lands accessible by track improvement and by the creation of new roads and the provision of services including water, housing, electricity and drainage. The hill lands must be provided with well-planned systems of shelter belting.

The steeper land on the hills and valley sides could well provide valuable forests and the whole might be established on the basis of Sir George Stapledon's proposals for a national park which would provide valuable touring grounds that could offer facilities for fishing, walking, riding and mountaineering.

Cattle problems

It would be easy to extend the list of the benefits which an improved pastoral agriculture holds out for Britain. For example, material benefits would accrue if sheep and cattle could be freed from bowel parasites, for ruminant animals, when free from these parasites, are better producers of meat and milk. On a national scale it should be no more difficult to attain nematode-free animals than it has been to establish tuberculosis-free cattle.

Again the concept of multiple litters in the ewe and of twinning in cattle through appropriate stock management, coupled with hormone treatments, need be no more a 'pipe dream' than was artificial insemination only 20 years ago.

Plant breeding

The scientific breeding of herbage plants in the modern sense is less than 50 years old. Selection has to a large extent been based on morphological characters, including leafiness and the ability to produce tillers in profusion. The breeder is now able to select for physiological characters associated with quality and we shall no doubt find new characters relating to quality which are heritable.

These are a few of the new developments that the farmer of the future will accept as commonplace. It is research and technology—always the handmaids of progress and the major tools of forward-looking communities—which will make these advances possible.

* *Silage* by S. J. Watson and A. M. Smith. Crosby, Lockwood & Son Ltd., London, 1956. Price 13*s.* 6*d.*

For Distinguished Service

Mr. W. D. Akester, Past-President of the Agricultural Engineers' Association, after being presented with a silver cigarette box for his services to the Association and the agricultural engineering industry by Mr. G. C. Waghorn, President of the Association (left). *On right, Air Vice-Marshal F. L. Hopps, C.B., C.B.E., A.F.C.*

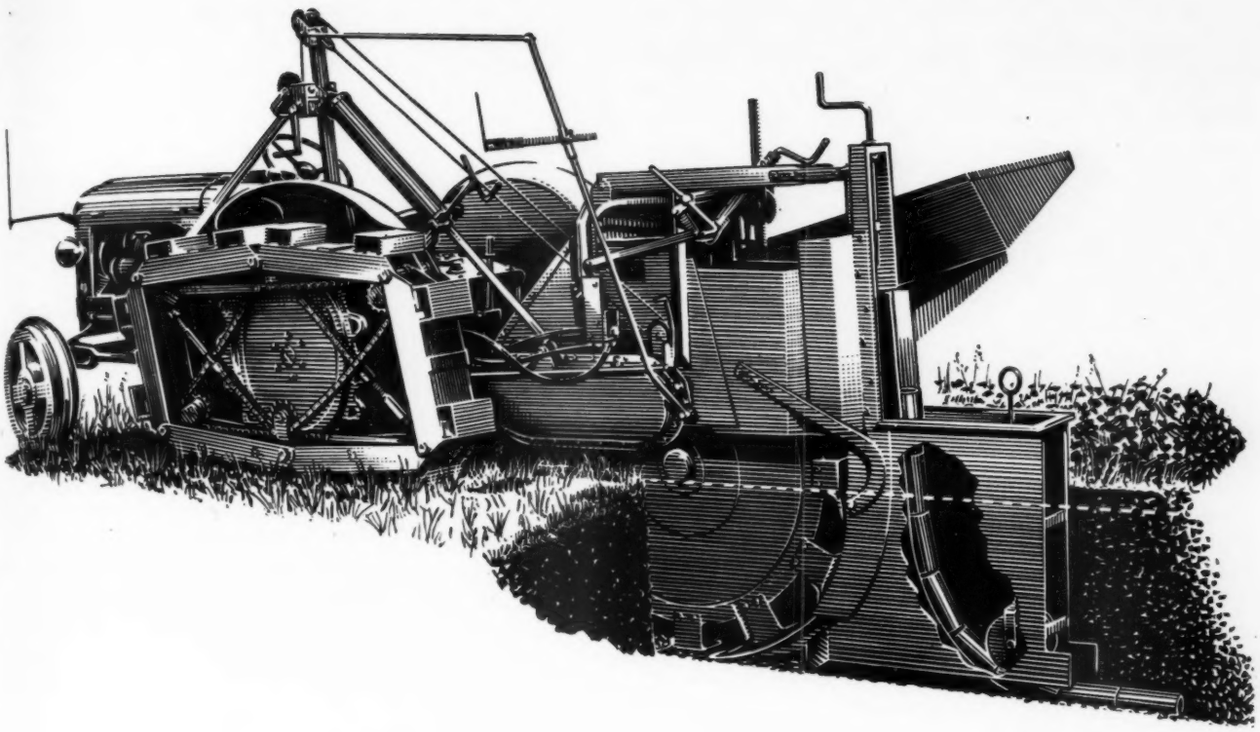


Diagram to show how the trencher and pipelayer works. The special 'Rotaped' wheels are fitted so that the machine is adequately supported on marshy ground

Draining Wet Lands

FRANK MOORE

One of the major reasons for unsatisfactory crop yields is lack of effective drainage. It has been estimated that well over half of the arable land in many European countries is in need of drainage.

THE need for subsoil drainage is evident by a wet and spongy surface, by the presence of rushes and other inferior herbage, by the stunted and sickly appearance of growing crops and by the presence of pools of water and dark-coloured damp patches on cultivated fields. Wet land may be unable to bear the weight of machinery or stocking by farm animals without serious damage to soil structure. Moreover, wet land is slow to warm up.

When agricultural land is properly drained soils are more easily and sooner worked, enabling arable crops to be grown where in some cases only grass was possible before. The water is carried away from the surface layers of the soil, allowing air to enter the pore spaces and plant roots to extend downwards.

As a result, the action of micro-organisms is stimulated and consequently there is a more rapid release of plant food. Lime and manures act better and more quickly and certain parasites of livestock, such as liver flukes, are reduced as surface moisture is removed. Poor herbage in pasture land quickly disappears and is replaced by superior grasses and by white clover. Even in very dry years drained land gives better results than does undrained land because the plant roots are so much better developed.

Methods of drainage

Field drains may be open ditches or covered pipelines, or a combination of both. Open drains are less desirable, as they occupy land that might otherwise bear a crop; they interfere with cultivation, harbour weeds and are costly to maintain. In practice most systems of farm drainage are a network of covered field drains leading to one or two ditches which flow into a natural waterway. The pipes used for drainage are normally 2-in., 3-in. or 4-in. internal bore with up to 6-in. pipes laid for the main drains.

When rainfall exceeds evaporation and water accumulates the soil becomes saturated and the water table rises. When the soil contains more water than it can hold against the force of gravity this excess of water is carried

away by the drains and in winter these are likely to run almost continuously or after every fall of rain. The porous pipes in the drains first absorb the water in their bodies and when saturated will release it to run into the open ditches.

Arrangement of drains

The drains have to be arranged to remove the water as effectively as possible at a minimum of cost and an efficient and economical method of digging these drains is essential. The distance between drains is determined by the texture of the soil. Clay soils drain more slowly than open-textured soils and therefore the drains must be closer together. The depth of the drains depends on the rate of percolation; in heavy clays they will not act with sufficient rapidity unless they are spaced comparatively near the surface—normally 2-2½ ft. On the other hand, drains may be placed at a greater depth in light soils because the 'draw' is greater.

The gradient of the drains is as much as conditions will allow, but on steep slopes drains are normally laid obliquely across the slope—the most effective way of intercepting water. In practice the minimum gradient is about 1 in 250, although in some areas, such as fenland, drains are laid horizontally from ditch to ditch and flow out of each end. The fall of the drains must be uniform and a careful joint must be constructed at any juncture between lines of drains.

Planning the system

The actual system of drainage is usually prepared by a survey team who follow either (1) a natural system, where a line of tiles with a few branches follows the natural outlets from higher to lower levels; (2) an interception system where an oblique line of tiles is laid to catch water seeping from higher to lower land and remove it before it reaches the bottom; or (3) a parallel system where parallel lateral pipelines discharging into main drains carry the water to some natural waterway. The skill of the survey team in designing a suitable system has a great bearing on the efficiency of the whole system.

The normal practice is for a level survey to be made and pegs are driven in marked with their own individual level. The locations of the drains are then planned and marked out and a sketch is prepared for the trench digger operators from which they can work. The drain tiles are then carried on to the land and laid in convenient rows along the lines of the proposed drains.

Mechanical trench digger

The Howard trench digger is self-propelled and driven from a special tractor whose half tracks are particularly suitable for maintaining a steady level. The depth of the trench can be adjusted to a maximum of 48 in. and the width varied from 7-10 in. in order to accommodate varying sizes of pipes.

Basically the machine consists of a large rotor fitted with specially designed cutting blades moving in the opposite direction to the forward motion of the tractor. This rotor is raised or lowered hydraulically and carries the soil upwards to a point where it is discharged to one side, leaving a neat line of spoil on the right side of the machine some 9 in. from the trench. Heavy front wheels counterbalance the weight of the digger and an adjustable crumber is fastened on the rear of the rotor to ensure a clean bottom to the trench with just sufficient crumb to keep the pipes properly bedded.

The machine is operated by one man who, from his position beside the cutting rotor, can completely control the steering, the clutch and the hydraulic grading of the machine.

The grading, when carried out by an experienced operator, gives immense accuracy, well within the standards required, no matter how uneven the surface of the field may be. A pipe layer supplied by a second man and fastened to the rear of the crumber enables digging and pipe laying to be done in one operation. The spoil is conveniently deposited for easy back filling and by virtue of its design and balance, the machine can work in extremely wet conditions, without becoming bogged.

The actual speed of work varies with the depth of the trench and the type of soil as well as the experience of the operators. There are six working speeds to suit any soil condition. Normal working speeds are from 100-200 metres per hour, but in estimating any particular scheme allowance must be made for the time spent in driving the machine from one trench to another and the construction of silt basins and outfalls etc. It is possible for an experienced operator to keep within a tolerance of ¼ in. level under reasonably good conditions.

The Howard trencher and pipelayer, mounted on a Fordson tractor, ready to move to a new position

A stone hook is positioned to clear large stones which may be brought up by the rotor, though, of course, when boulders are encountered that are wider than the width of the trench the machine must be lifted over them and they must be dug out by hand.

Method of operation

The mechanical digger would work systematically from the drainage plan

Photos: U.K. Min. of Agriculture

Left: *A waterlogged cornfield.* Right: *A tile outfall with a brick head wall*

and when these drains are to flow into open ditches the digger is backed up to the ditch, the rotor lowered to the required depth and a trench cut clean into the ditch bank. Grading is carried out by means of sighting rods which are set to the correct levels across the field. The pipes are normally laid as the trench is cut and the trench filled with the clinker to within 20 in. of the surface. This clinker or other suitable material keeps the soil open, allowing the water to reach the pipe and preventing silt from forming.

Special tiles are normally used at the discharge points into the open ditches, since ordinary porous tiles can be broken by the action of frost. The last tile should be cemented into a brick or concrete foundation which cannot be undermined by running water and a grating fastened over the end in order to prevent entrance of vermin.

On completion of the laying of the pipes and clinker the trenches are back filled with an angle blade on a tractor and frequently in drainage schemes a field is then mole-ploughed across the lines of the tile drains to a depth just above the level of the tiles, in such a way that excess moisture is rapidly removed from the field. Frequently water may be seen pouring from the pipes before the first 100 metres of work has been completed.

The introduction of this machine has enormously increased the amount of drainage that can now be economically carried out. A small mechanised team can rapidly drain land which formerly required many weeks of manual labour. A contractor's outfit would normally include a tractor and a low-load trailer as well as the trench digger. The tractor and trailer would transport the digger from site to site more rapidly than on its own tracks and also carry clinker and pipes.

Crops and Climate

Some indication of the impact of weather on agriculture is to be found in the yearly report, *The State of Food and Agriculture*, 1960, issued by FAO.

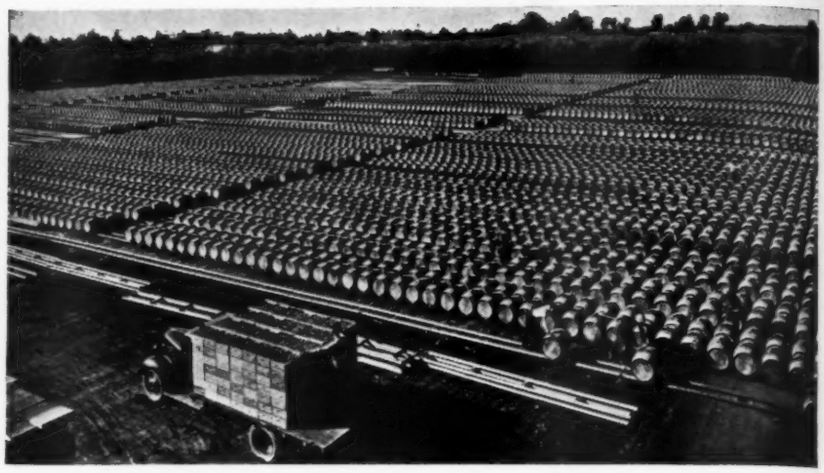
Efforts have been made to reduce the impact of weather through irrigation, the introduction of special seed and mechanised cultivation to make the best use of available rainfall, flood control measures and the control of pests and diseases. These may reduce, but they fail to eliminate, the age-old dependence of agricultural production on weather.

On a world basis, declines in total agricultural production of 5-10% in a single year are common. Larger fluctuations, says the report, appear mainly in North-West Africa, parts of the Near East and certain rice-growing countries in South-East Asia, where rainfall is most uncertain. Thus the total output of agricultural products is estimated to have dropped in Algeria by about 10% in 1955-56 and in 1957-58, by 15% in Morocco in 1957-58, and by 21% in Tunisia in 1955-56. In Turkey, production fell by nearly 20% in 1954-55. In Iraq, Jordan, the Lebanon and the Syrian region of the United Arab Republic droughts have now caused winter crop failures for three successive seasons. In South-East Asia monsoon failure reduced rice production in Burma by 14% in 1957-58 and by about 20% in Thailand in 1954-55 and 1957-58.

Outside these three most vulnerable regions bad weather has reduced output in Canada, Japan and Yugoslavia in recent years. Cyclones are frequent in the Caribbean and in the Indian and Pacific Oceans. Hardly a year goes by without serious crop failures in parts of India and China.

The report illustrates that in some major wheat-producing countries the variability in output is mainly due to fluctuations in yields, although the weather affects also the amount of land which can be sown or harvested.

Crop fluctuations have been responsible for the appalling famines that have occurred since Biblical times, and in a major famine in Bengal as recently as 1943 one and a half million people perished. Improved storage facilities and, above all, transport have since helped to mitigate such disasters, so that localised shortages have been overcome by moving stored supplies from other areas and other countries.



Barrels of Spanish-type green olives fermenting in the sun

The olives must remain on the tree until they are ripe and great care must be taken in picking, as the fruit bruises easily

Olives—The World's Oldest Fruit

J. B. KEMMERER

THE olive, the oldest fruit known to man, has been growing for more than 4,000 years. The plant received frequent mention in the Bible, the best-known reference being to the dove which returned to Noah bearing an olive branch, a sign that the flood was receding.

The olive tree is indeed one of the world's wonders, for it is the longest-living fruit tree known. Some trees, believed to be more than 1,000 years old, are still bearing.

The tree does best in a warm, dry climate, where there is plenty of water, but no summer rain, fog or extreme cold. The olive industry was originally established on the shores of the Mediterranean, where the oil is known as the poor man's butter and a Spanish peasant will often make his lunch of a loaf of bread soaked in olive oil.

Olives are today eaten in all parts of the world, but few people are aware that the fruit needs special treatment before it can be eaten. Fresh from the tree the fruits look tempting, but they are, in fact, as bitter as gall.

The ripe olives are stored in brine in huge redwood vats and can be kept for a year until required for processing

Introduction into the New World

The plant was introduced by missionaries into the Americas, and in 1769 it is recorded that it was planted at the San Diego mission in California to provide them with olive oil and as new missions were established, its cultivation was further extended.

At first the fruits were picked unripe and pickled, because in the countries from which the missionaries came olive fruits are attacked by the olive fly before they can ripen, but it was discovered in California that they could be allowed to ripen fully before pickling in salt. The resulting product had a smooth nut-like flavour, devoid of all bitterness.

Birth of an Industry

Up to 1910, an open olive barrow was a familiar sight in grocers' stores. Then it was discovered by Mrs. Freda Ehamnn—a pioneer grower in California—that ripe olives could be cooked and kept in sealed cans and as a result the canned olive industry was born.

Today 30% of all the olives grown in California are processed by the *Lindsay Ripe Olive Co.* The harvest begins in September and extends into October, with as much as 270 tons being received in a single day.

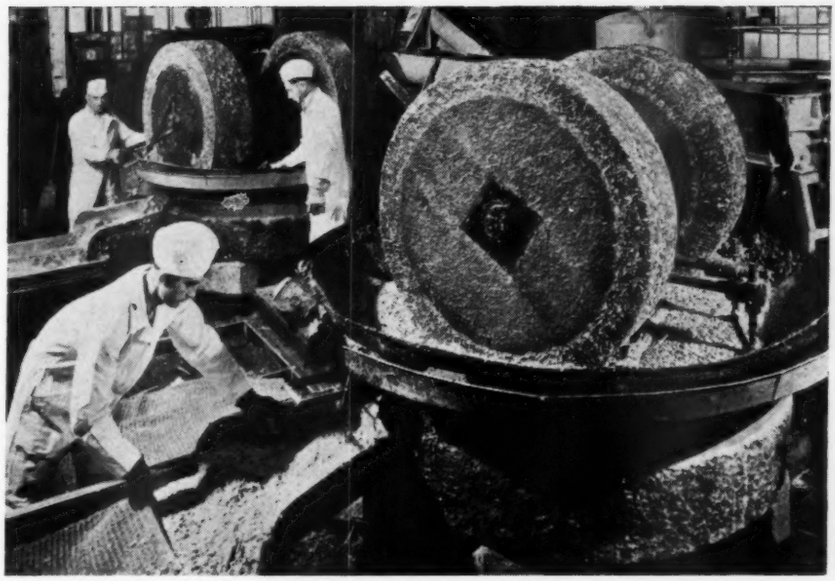
Processing the crop

The olives arrive in lugs, each carrying 35-40 lb. The contents of each lug are turned out on to a belt, any fruit clusters are broken up and twigs or leaves are removed. The fruits are then graded for size, the smallest being sent for processing as Spanish green olives. The bulk pass into 6,000-gal. wooden brine tanks, in which they are stored in an 8% solution of salt. They can be kept in this way for up to a year, till required.

The first operation in processing is sorting on conveyor belts to remove any overripe or damaged fruit. The sound, ripe olives are then cured by alternate applications of caustic soda solution, water and air over a period of nine days. This oxidises the fruit and produces the familiar black colour.

Then the olives are repeatedly washed, the water being changed every four hours and the fruit receiving nine washings to get rid of all traces of caustic soda and bitterness. They are then twice treated with brine, raised to a temperature of 185°F, the treatments each lasting for 24 hours.

The treated olives are then mechanically graded for size and delivered for filling into cans and after sealing the cans are put into large pressure cookers; the temperature is then raised to 240°F and so held for over an hour to ensure complete sterilisation. Finally, the cans are water-cooled, labelled and packed, ready for shipment.



Over-ripe and broken fruit being macerated in rolling mills

Spanish olives

In the processing of the smallest olives they are placed in a 1-2% solution of caustic soda to remove the bitterness, then carefully washed and pumped into 50-gal. barrels. The wash water is replaced by 10-15% brine, the barrels are closed and sent to the fermenting yards. After six months the contents are inspected, graded and rebarrelled, ready for shipment.

Olive oil production

Over-ripe fruit is unsuitable for canning, but will nevertheless make good oil. The olives are first washed in warm water and are then sent to a disintegrator. The macerated material is reground, packed into strong bags and twice pressed, once at 5 tons per sq. in. and then at 30 tons per sq. in. The expressed oil from each hydraulic press is separately centrifuged, washed and filtered and then allowed to stand for two months to allow any sediment to settle out.

Olive growing has become a major industry in California, largely as a result of the war, and the trade in green and ripe olives is well established.

Left: *Cans being filled with graded olives on a continuous canning line.* Right: *The filled cans are sealed and placed in large cookers and sterilised for 62 minutes at 242°F*

The laboratories of the National Vegetable Research Station. The glasshouses and experimental areas are beyond

Recent Advances in Research on Vegetables

The National Vegetable Research Station in Warwickshire has made excellent progress since its establishment only 12 years ago and the results obtained will be of interest to workers on other crops.

THE necessity for increasing food production in Britain during the 1939-45 war resulted in the establishment of the National Vegetable Research Station at Wellesbourne in Warwickshire, with a sub-station at Paglesham, Essex, in 1949 with a total of over 500 acres of land.

Eight research sections have been set up to deal with the breeding of improved varieties, the improvement and maintenance of soil fertility, the factors affecting crop growth, the study of irrigation, the control of pests, diseases and weeds, the planning of experiments and also the analysis of the results.

Plant Breeding Section

The main breeding problems now being studied are:

Crop	*Problem*
Asparagus ..	To produce a strain of seed which will give only male plants.
Brussels sprouts	To improve uniformity, yield and quality.
Cauliflower ..	To improve earliness and curd quality in Cambridge No. 5 early cauliflower.
Lettuce ..	To produce a variety or varieties of summer cabbage lettuce resistant to mosaic, virus diseases, downy mildew, *Botrytis* and tip burn.
Onion	To develop uniform high-yielding F_1 hybrids.
Pea	To produce an early-maturing, winter-hardy wrinkled pea.
Red beet ..	To breed a globe beet of good colour, which does not bolt when sown early and has a single-seeded fruit.
Spring cabbage	To produce a dual-purpose variety suitable for either spring greens or hearted cabbage.
Tomato ..	To introduce resistance to stem-rot caused by *Didymella* into outdoor commercial varieties.

Chemistry Section

Studies are being made of the effects of inorganic and organic manures, cultivation practices, crop rotations etc. on soil fertility and crop growth, and of the chemistry of processes taking place within the soil and within the plant, relevant to crop growth.

Long-term field experiments dealing with various aspects of cultivations and plant nutrition were started in 1954. In general, deep cultivation has benefited peas, spring cabbage, leeks and Brussels sprouts, but no differences in yield have been obtained from different depths of distribution of added fertilisers. For early potatoes, spring cabbage, leeks and summer cabbage, there was, on average, no advantage in dividing the inorganic nitrogenous fertiliser dressing into several small doses to be applied at intervals during the growing season.

One experiment, designed to give fundamental information on the nutrient requirements of vegetables, comprises 54 different FYM - NPK manurial treatments. Early potatoes, spring cabbage, carrots and red beet have given yield responses to nitrogenous fertilisers. In the period 1954-56 only red beet gave an increase in yield attributable to added potash, but in 1957-59 all four crops in the rotation gave higher yields on plots where potash fertilisers had been applied.

In 1955 early potatoes gave an increase in yield attributable to added phosphate and in 1957-59 small yield increases were obtained with red beet, early potatoes and spring cabbage following applications of 1 cwt. per acre of superphosphate. Higher rates of superphosphate application did not produce a further increase in yield with these crops.

All crops have given large increases in yield on plots where FYM has been applied and there has been a rapid deterioration in soil structure on those plots which had not received FYM. On plots which had received FYM in each year from 1954-59, but did not receive FYM in 1960, the yield of lettuce was lower by 8% than on plots which had received FYM in each year from 1954-60. With peas, however, this effect on yield was reversed, and with summer cauliflowers the yields from the two series of plots were the same. FYM in combination with the higher rates of application of fertilisers produced higher yields of early cauliflowers (75%), summer lettuce (55%) and early peas (10%) than were produced by the higher rates of fertiliser alone.

Investigations have also been started into the activities of certain groups of soil micro-organisms. The physical condition of the soil and climatic conditions both affect the supply of oxygen to the micro-organisms and the immediate object of the work is to measure the effect of variations in soil oxygen concentration on microbial activities and to determine the distribution of oxygen in soil.

The results have shown that nitrification and the aerobic decomposition of organic matter were not inhibited, and that denitrification and the anaerobic decomposition of organic materials were not induced until oxygen concentrations of the microbial surfaces were less than about 10^{-6}M.

Physiology Section

Plots of direct-seeded crops in which there was a continuous range of plant densities and/or patterns of plant arrangement were used in 1960 for onions, cabbages, peas, carrots and red beet. The results showed that the optimum spacing for cabbage was dependent on the amount of nitrogenous fertiliser used and that the pattern of plant arrangement could affect the yield of carrots, onions and peas.

Previous results with peas and onions, grown at commercial plant densities, have shown that square patterns of plant arrangement (where each plant is equi-distant from its four nearest neighbours) can give yields 20-25% greater than those obtained with rectangular arrangements where the distance between rows was 12 times the distance between plants within a row. Similarly, when the number of plants per unit area was constant, the yield of carrots was increased by 25% by reducing the row spacing from 24 in. to 12 in.

Irrigation Section

Supplementary watering generally results in the production of more foliage; the accompanying increase in yield of other parts of the plant, such as cauliflower curds or turnip roots, though substantial, may often be less than might be expected from the quantity of foliage produced.

The results indicate that there is no universal watering treatment suitable for all vegetable crops; furthermore, some crops appear to be more sensitive to drought or to abundant water supply at certain stages of their growth than at others.

Peas watered before the flowers opened produced increased quantities of haulm but little increase in crop, as compared with plants which received only average rainfall. On the other hand, watering peas after the pods had set resulted in a considerable increase in crop.

The yield of early summer cauliflowers was increased by irrigating before 50% of the available water within the root zone had been used up. During warm, dry weather this treatment might necessitate watering at weekly intervals.

Irrigation applied only at certain stages of growth gave worthwhile increases in yield of early cauliflowers,

An experiment to determine the nutrient requirements of young seedlings

The corridor of a small compartmented glasshouse for isolation work in plant breeding

early potatoes and garden peas. With early summer cauliflowers watering treatments based on specified deficits determined by the use of the irrigation indicator and by Penman estimates did not differ in their effects. Results have indicated that the root system of lettuce was altered less by the irrigation treatment than by soil factors, such as compaction and the presence of lumps of farmyard manure.

In experiments with runner beans the weather at the time of flowering was found to have less effect on the proportion of flowers which set pods than is generally believed. With adequate rainfall, or irrigation, the development of flower buds was found to be accelerated; this resulted in more flowers opening early and a consequent increase in yield.

Applications of FYM to a sandy loam during a period of six years increase the available water capacity of the soil. The increased available water in the 'plus FYM' soil was found to be held at a low soil moisture tension and, therefore, was readily available to plants.

Entomology Section

Research is being carried out on a number of insects of economic importance to vegetable crops.

Cabbage root fly

The larvae or maggots of this fly feed on the roots of brassica crops, causing stunting or death of the plants. Methods of control using insecticides for the transplanted crop, for plants raised in pots, and for seedbeds have shown that increases in yield of 20-110% may result from insecticidal treatment of summer and autumn cauliflowers and summer cabbage.

Work on the natural control of cabbage root fly has shown that carabid beetles, often present in considerable numbers in the soil, feed on the eggs and larvae of the cabbage root fly and greatly reduce their numbers. Losses during the egg stage are most important and field studies have shown that the largest numbers of eggs are lost when the beetle activity and density are greatest.

These beetles are more readily killed by insecticides than are cabbage root fly eggs or larvae, and experiments have shown that the use of land containing residues of insecticides can lead to a reduction in the number of predatory beetles and an increase in crop damage as compared with land containing no residues.

Carrot fly

This pest causes serious crop losses on carrots, parsnips and parsley; the larvae burrow into the roots and may kill or stunt the plants, or make the mature crop unmarketable. On carrots, seed treatments and seedling sprays containing gamma BHC have been found to be effective, but to avoid off-flavour of the crop caused by this chemical the dosage rate at which it may be used is less than is needed for complete control.

Dieldrin is less effective than gamma BHC, but since it has been found not to cause off-flavours it may be used at higher rates than gamma BHC as a seed dressing, and also as a foliage spray with satisfactory results. Both chemicals are much less effective on fen soils with a high humus content than on medium sandy loams.

Experiments have shown that low rates of aldrin and dieldrin, when rotavated into the soil, will give almost complete control of carrot fly, not only in the year of application, but also in the following year. Similar good results have been obtained on mineral soils and on fen soil, but a higher dosage of insecticide is required on fen soil.

Little or no effect on crop flavour has followed the use of dieldrin in this way, but aldrin has caused marked loss of crop flavour in certain cases. Chemical analyses have shown that very little dieldrin is taken up by the carrot crop and that this is almost entirely limited to the skin of the roots and is removed by peeling.

Lettuce root aphid

Several insecticides have been used against this common pest of outdoor lettuce. A pre-sowing soil treatment with diazinon has given good results, but certain varieties of lettuce have been found resistant to attack by the pest and this may be a better method of approach to the problem.

Glasshouse evaluation of herbicides at the N.V.R.S., Wellesbourne

Plant Pathology Section

This section is concerned with the study of diseases of vegetables caused by fungi, bacteria or viruses.

Watercress crook root

Crook root is caused by a fungus which attacks and distorts the roots of the cress, often resulting in the death of the plant. It is widespread and responsible for very considerable crop losses. It has been shown that the disease can be controlled if minute quantities of zinc compounds are introduced into the water in the cress bed. The method by which this is done depends upon the water supply.

If the beds receive water from a single source, zinc sulphate can be 'drip-fed' into this source so that a concentration of 0.1 p.p.m. of zinc is maintained in the water. If, as is often the case, the individual beds receive supplies of water from several sources, it is necessary to apply the zinc as 'zinc frit', a finely powdered glass containing zinc. This is spread on the floor of the upper part of the cress bed at the rate of 0.3 lb. per sq. yd.

From such plants the disease spreads to others, the bacteria probably being carried in wind-blown raindrops. It has been found that the disease can be very largely controlled by soaking the seed for 24 hours in a 0.02% solution of streptomycin and this treatment is now being applied commercially.

Tomato stem rot

This disease, caused by the fungus *Didymella*, has been studied on the outdoor crop, which is often severely affected. Previous studies have shown that the disease can be controlled to a large extent by the use of hygienic precautions and by spraying the plants with captan or maneb. Research is now being concentrated on the breeding of hybrids which are resistant to infection.

Parsnip canker

This is the most common disease of parsnips. Two fungi, species of *Itersonilia* and *Phoma*, both cause a black type of canker which is widespread and severe, especially in wet seasons. Carrot fly attack, common on parsnips, is often associated with canker. Elimination of the insect by soil treatment, however, does not necessarily reduce the amount of disease.

Lettuce mosaic

Serious losses often result from this disease, especially in summer lettuce. Experiments using seed containing less than 0.1% infection have shown that crops can be produced from such seed which are almost free of the disease if they are grown in isolation from infected crops.

Leaf and pod spot of peas

This group of diseases is caused by *Ascochyta* and related fungi which cause lesions on the stems and spots on the leaves, pods and seeds of peas. Soaking seeds in suspensions of various fungicides (*e.g.* captan and thiram) has given a very high degree of control, but complete elimination of the disease has not yet been achieved.

Clubroot of brassica

Field studies in progress since 1956 have shown that commercial aldrin preparations will give some control both when applied as emulsions around the young plants or when the clubroots are dipped in suspensions of aldrin. The degree of control achieved, however, is no greater than that obtained by more conventional treatments (*e.g.* with calomel).

Powdery mildew diseases

Research has shown that some of these diseases can be controlled by the application to the soil of compounds containing various metals, notably zinc and cadmium, which are absorbed by the plant.

Weeds Section

This section is engaged in studies of both cultural and chemical methods of weed control and of certain aspects of weed behaviour, such as seed germination and dormancy.

Work is in progress on the weed population of the long-term field experiments maintained by the Chemistry Section. When the experiments started the field had a very high population of weed seeds in the soil, averaging 229 millions per acre in the top 6 in.

Under vegetables the population progressively diminished until after four years it had been reduced to only one-twelfth of the initial level. Not all species were reduced to the same extent, however, and differences have been found between plots receiving different basic cultivations. This increase was somewhat greater on plots which had received rotary cultivation than on those that had been ploughed.

Experiments carried out over a period of four years showed that monuron was highly satisfactory for the control of annual weeds in asparagus beds, and similar results were obtained with simazine. Simazine has also proved effective as a residual pre-emergence spray in sweet corn, broad beans and field beans. Recent trials have shown that dinoseb-amine, familiar as a post-emergence spray for peas, can be used successfully at higher rates for residual pre-emergence weed control in runner and French beans.

Important work is also in progress to examine the effects on the growth, yield and marketability of vegetable crops, of low doses of hormone weedkillers commonly used for spraying nearby cereal crops. The object is to define injury symptoms so as to facilitate identification in cases of suspected spray drift and to discover what dose levels will cause financial loss.

Groundwater Resources

FAO is organising a project to test and demonstrate methods for the development of groundwater resources in limestone in Greece. The 3-year project includes pilot hydro-geological studies, test drilling and test pumping.

Our Next Issue

The September issue of WORLD CROPS will be a special number dealing with Agricultural Aviation. Articles will include:—

The Choice of an Agricultural Aircraft by R. J. Courshee, B.Sc.

Making Maps for Agriculture —Part 1. *Topographic Mapping from Air Photographs* by B. Sloane, B.A.

Aerial Farming in Australia by L. T. Sardone.

From Man Power to Machines —Part 2. *Methods of Organising the Mechanisation of Small Farms* by J. C. Hawkins, B.Sc., N.D.A.

From Bush to Pasture

THE stocking of semi-arid grazing land is inevitably low and such land can carry no heavy capital investment for bush and scrub clearance. These areas are, however, so heavily infested with various scrub and bush weeds as a result of overstocking and uncontrolled grazing that grass regeneration is inhibited.

The drier parts of Kenya have several million acres of this scrub-infested land and the Government is concerned with the restoration of their grazing potential, particularly in the African reserves. Many experiments have been carried out by the Department of Agriculture with both light and heavy machines in an endeavour to clear or control the scrub growths. A reasonably economic and practical method has been found to be by the use of a Mk. IXA *Holt* bush breaker. Where the bush was previously impenetrable, a reasonable grass cover was obtained within two years by the use of this machine. With the situation thus brought under control, further pasture regeneration by reseeding becomes possible.

Any method of bush clearance and control must come within the economic limits of the cost which this type of land will stand. In the initial heavy clearing using heavy tractors and the Holt bush breaker, it was found possible to keep the cost down to about 30*s*. per acre, even where the bush is most heavy. Where heavy thicket is interspersed with areas of lighter bush, the overall cost may be as low as 15*s*. per acre when the operations are on a large enough scale.

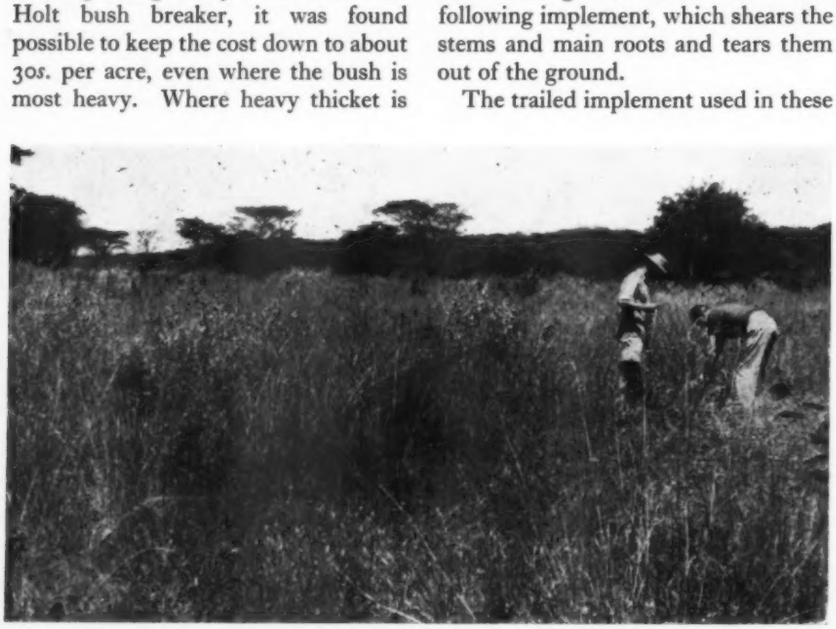
Holt Mk. IXA three-gang bush breaker crushing dense leleshwa and thorn bush in Baringo Native Reserve, Kenya. Work undertaken by Kenya Government Agricultural Department, 1957

This bush breaker is a trailed implement, designed for use behind a crawler tractor, which is fitted with a heavy pusher bar made of 80-lb. railway metal. This bar can easily be fitted to the 'A' frame of an *International Harvester BTD*6 tractor. This lays the heavier growth in the track of the following implement, which shears the stems and main roots and tears them out of the ground.

The trailed implement used in these trials consisted of a gang of three very heavy, angular, rotary cutters with a crushing width of 11 ft. and a total weight of 4,700 lb. A crawler tractor thus fitted first lays the heavier growth in the track of the breaker gang and the blade edges, striking the material at an angle of 25°, then exert a shearing and penetrating action on the brushwood and tear roots out of the ground.

In these operations, the forward speed ranged between 1 and 3 m.p.h. and the overall rate of work was between one and 2½ acres per hour, according to the bush and ground conditions. The tractor driver is generally impeded by overhanging vegetation and it has been found necessary to protect him with a strong steel cab or cage. It is essential also to carry an axe to release timber which occasionally gets jammed between the breakers and their drag links, and a crowbar is also required to lever a breaker over the occasional awkward obstruction, such as a severed tree stump.

This implement can be used either singly or in gangs of two, three or five for various operations such as chopping up crop residues—maize, tobacco, cotton, castor, pineapples or sugar-cane—or for turning in green cover crops, such as lupins and other legumes, for the improvement of pastures by destroying any invasions by shrubby weeds and for making or renewing fire-breaks in forest areas.



Baringo Reserve, Kenya, cleared of dense leleshwa and thorn bush by Holt Mk. IXA three-gang bush breaker. The first crushing was in 1957 *and the second in April* 1959. *Rhodes and molasses grass were broadcast later*

RAINING PLANT FOODS

'It Droppeth as the Gentle Rain from Heaven'

W. SHAKESPEARE

When organic matter is incorporated in irrigation water, not only are plant foods being applied as well as water, but the drudgery of muck removal from the stables and cattle byres by dung fork and muck spreader can be considerably reduced.

Some of the 130 young heifers standing on the slatted floor raised 20 in. above the main floor. Dung and urine build up and is released at intervals and washed down to the slurry tanks

THE recent Aberdeen Irrigation Conference was attended by nearly a thousand Scottish farmers and there was also a large contingent from 'over the Border'. It was held on Westerton Farm, where a complete system of organic irrigation has recently been installed; this combines the principle of zero grazing and large-scale silage production with a system of drainage for the removal of all loose droppings —dung, urine and runnings—from an immense silage house, from under the runways used by the milking cattle and from the byres of the young heifers by water into a central sludge pit. When sufficient has been collected the mixture is stirred up and pumped out over the adjacent fields—100 acres in all—using a pair of rain guns, which are moved from point to point until the whole area is covered.

The meeting was presided over by Mr. Maitland Mackie, Jun., a leading Scottish farmer, and the papers given first dealt with the practicability and economics of irrigation for grassland and arable crops, and then went on to consider the problems of dung disposal and the new system of organic irrigation. The following is a short summary of the papers* submitted to a very keen and interested audience:

Grass and Arable Irrigation *by G. Newman* (*Manager, Reading University Farm*)

Lack of water is only one factor which limits crop growth, and water applications can be a waste of money unless the crop is otherwise well husbanded. Irrigation, in other words, is no substitute for poor cultivations and inadequate manuring. Grass, in particular, needs nitrogen and spectacular responses have been obtained at Reading with irrigation and using massive applications of nitrogen.

If the supply of water is limited, the best results are to be obtained by restricting its use to a small acreage of grass and by calculating the requirements using moisture tensiometers, so that the water deficit can be made up accurately instead of by guesswork.

A grass crop will respond to early irrigation, though in most springs this is not really necessary. It is not until after May that water can double the yields of dry matter; large quantities of grass can thus be produced cheaply during a period of rising milk prices.

The additional grass obtained in this way must, of course, be utilised efficiently. A low stocking rate of low-yielding cows is obviously bad business; the source of water, too, must not be too far away, otherwise irrigation is not economic.

With arable crops, a satisfactory response can be obtained by watering when the products of photosynthesis—the proteins, starches and sugars—are being stored in the plant, *e.g.* tuber formation in potatoes, root swelling in beet, and pod filling in peas. Of these crops, potatoes give the biggest financial return from irrigation and should be given priority.

Irrigation Economics *by J. S. Nix* (*Cambridge University School of Agriculture*)

With 'free' water and portable equipment the installation cost of an irrigation system, including a tractor pump, main line and sprinkler line, will be on average from £20-£25 per acre, but will depend on the shape of the area to be irrigated, the disposition of

* Copies of these papers may be obtained from Farm Intelligence Ltd., 42 Parliament Street, London, S.W.1.

the plots and the position of the source of water. Thus the longer the pipeline, the greater the diameter needed to overcome friction losses, and so the cost will rise progressively. Rain guns are cheaper than sprinklers, but they need bigger pipes and bigger pumps owing to the greater pressure requirement. Other drawbacks are wind drift and higher fuel costs.

The operating costs, according to a recent survey, are about 45*s.* per acre-inch or £5 5*s.* per acre per year; roughly half of this represents depreciation and interest and the remainder are the variables—fuel and labour.

The returns from irrigation depend on the crop, the soil, the position and the skill in operation. With an operating cost of, say, £5 5*s.* per acre an extra ½ ton of potatoes or 1 ton of sugar-beet per acre is needed to cover the extra cost. As the average increase for potatoes is of the order of 2-3 tons per acre, irrigation of this crop will usually pay.

With organic irrigation, the larger the herd the cheaper the cost, *e.g.* £50 a cow for a 20-cow herd; £20 a cow for a 100-cow herd. The basic cost is fairly high, but costs rise only slowly with increased size of herd. The capital cost of an installation thus ranges from £900-£1,750.

The benefits lie in the full utilisation of the manure, including the urine, and in labour saving. With zero grazing, based on silage and with slatted floors in the cow house, there is a saving in straw and less spoilage of pastures by trampling and soiling with dung.

Irrigation in the North of Scotland *by A. Howie (Regional Director, North of Scotland Agricultural College)*

The principal considerations are the weather, the availability of water and the nature of the crops grown. The records show that there is considerable variation in the annual rainfall and the hours of sunshine in the northern counties of Scotland.

Plant growth is dependent on optimum moisture and the rate of transpiration is regulated mainly by sunlight. Whilst the total annual rainfall may appear to be adequate, a seasonal shortage of rain, coupled with a high rate of transpiration, could produce drought conditions in the drier, light-soil areas. In such areas irrigation should be seriously considered. Conversely, excessive moisture causes excessive growth of leaf and stem, lodging of crops, delayed ripening, lowered yields of grain, bulb or tuber, and reduced dry matter in grass.

Thus some method of assessing the water requirement of the crop in relation to the soil moisture should be adopted and the applications should be timed to meet the needs of the crop. It has been estimated that an acre of soil covered by a crop loses about 1 in. of water or 22,000 gal. every 10 days by evaporation through the leaves; bare land loses several times less than land covered by a crop.

To the dairyman anxious to maintain a level output of milk, or to the farmer growing early potatoes, irrigation during a dry spell will be of considerable value, but haphazard irrigation can be harmful and could help to denude a district of essential water.

Organic Irrigation *by T. Garbett (Farrow & Sons Ltd.)*

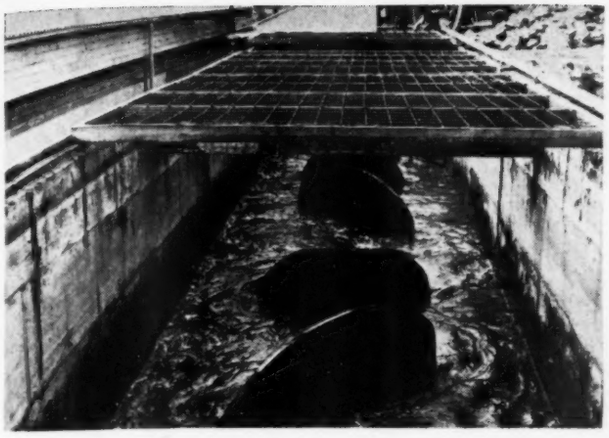
The utilisation of muck as a basic principle of farming has been employed for thousands of years; 'organic irrigation', or the mechanisation of the collection and distribution of animal manures over the land, is a new principle introduced into British farming some three years ago.

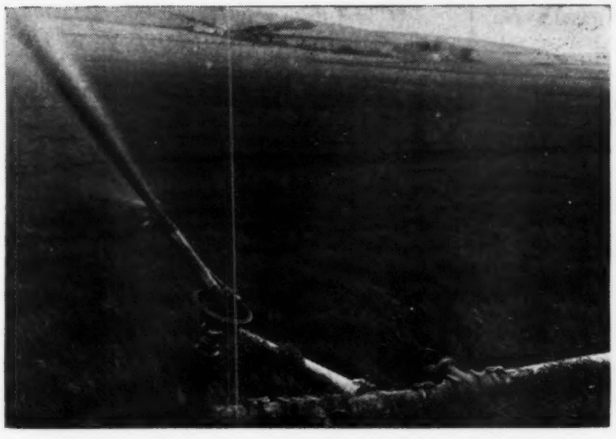
'Organic irrigation' means irrigation with water containing organic matter as opposed to irrigation direct from streams, rivers, boreholes or reservoirs. When the fields are dry the organic matter is diluted with greater quantities of water; if the fields are wet, the dilution is reduced. Thus, during a dry period, if there is plenty of water, the dilution rate may be as high as 15 : 1, and 1, 2 or 3 in. can be applied at a setting. With a lower dilution rate, as little as ½ in. need be applied.

The basic requirements are a drainage system from the animal houses and yards to a central collecting pit, agitators in the pit to stir everything into a consistent mixture, a piston pump with an overload release and sufficient pipeline to reach all the pastures which can be irrigated with the liquid manure available and a powerful rain gun which will cover a full circle of over ½ acre at the rate of ½ in. per hour. Ideally, the system should have two rain guns, one in use whilst the other is being set up in the next position.

The questions of taint and scorch need consideration. Experience has shown that so long as the dilution is correct there is no danger. Naturally, if the liquid manure is spread too thickly in dry weather, there will be both scorch and taint. The correct procedure is to irrigate a paddock after a grazing or after the grass has been harvested and to leave the field for three weeks before letting in the

The byres of the milking herd. In the centre are two rows of mangers flanked on either side by the slatted runway on which the animals stand to feed or along which they pass to the milking shed or silage house





Left: *The slurry tank seen half empty and showing four of the eight paddles which ensure uniform mixing. The grille prevents birds and small animals from getting in and choking the spray gun.* Right: *A powerful Farrow '50' rain gun spreading the liquid manure. The stop valves seen enable one gun to be shut off and moved while another is in operation*

cattle again (see also WORLD CROPS, 1961, **13**, 149).

Slatted Floors and Dung Disposal *by D. Soutar (Farm Buildings Adviser, North of Scotland College of Agriculture)*

Where stock are intensely housed there are great possibilities for the movement of farm materials by mechanical means. The handling of manure in the form of sludge is a good example of this technique. Not only is this justified on economic grounds, but it also eliminates drudgery.

The sludge may either be held in large reservoirs for use when it can do most good or it may be removed at regular intervals, irrespective of conditions. In most sludge systems water is added to the dung and urine in order to give it just sufficient mobility. However, unless some form of manure grinder is incorporated into the system, no material larger than chopped straw must be used in the cattle byres. The sludge channels and the floors on which the dung falls must have a slight gradient so that the material can be washed down. If the slope is excessive, the liquids will run off, leaving the solids high and dry.

A system may be evolved in which the manure is handled as a sludge merely to get it out of the building, the liquids being drained off and used for irrigation and the solid matter stored for future application using a foreloader. When a conveying channel and slurry tank system is used, sluice gates are fitted to retain the material in the channel and the sub-floor under the slatted floors is flooded to a minimum depth of 3 in. to ensure the proper disintegration of the solids falling through the slats. Then when the sluice gates are released the sludge in the channel will flow easily down the slight gradient of 1 in 100 into the slurry tank. Afterwards the sluice gates are replaced and the channels are refilled to the required depth with water as before.

The slatted floor system has resulted in a 50% saving in bedding straw because there is less spoilage by dung and urine, and one farm is now in a position of selling straw instead of having to buy straw to supplement supplies. With the automatic flow of material, the handling of the muck, which formerly involved much labour and drudgery, is no longer an embarrassment.

Organic Irrigation in Practice *by D. Hawthorne (Manager, Ashwell Farm, Somerset, England)*

This farm has been using an organic irrigation system for over two years. The slurry tank, 24 ft. x 12 ft. x 8 ft. deep, holds 15,000 gal. and is fitted with three wooden paddles; the mixture is delivered three times a week, the work being done by the cowmen. During the last two winter periods of eight months from mid-November to mid-March about 30 acres have been covered each time with nearly 1 in. of slurry. According to the analyses, this is equivalent to 3 cwt. of sulphate of ammonia, 3 cwt. of superphosphate and ¾ cwt. of muriate of potash per acre at each application.

The overall cost of this installation was £1,900.

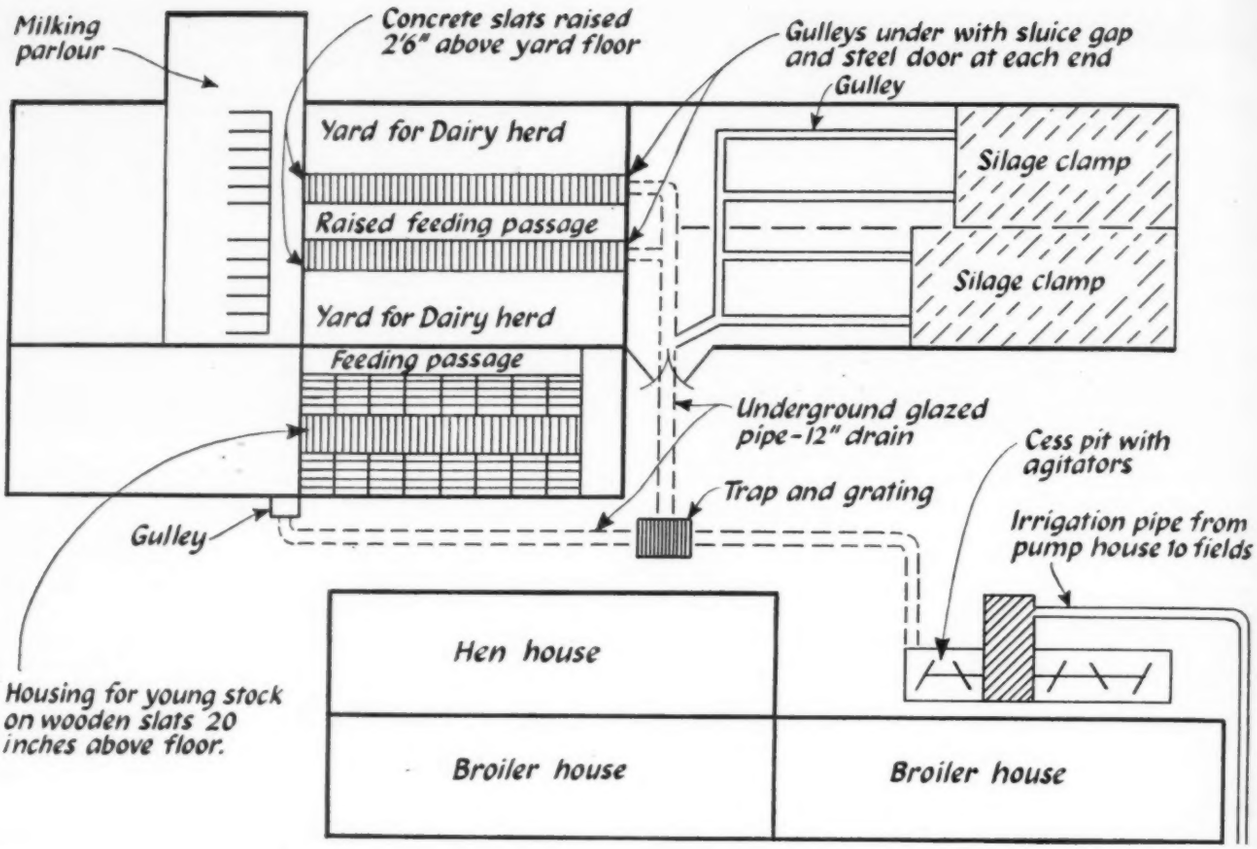
The advantages of the system are that it has proved an easier method of getting rid of the muck, it has reduced damage to the land by wheels and it has stopped the pollution of the river, to which exception was being taken by the local authorities.

An Organic Irrigation Scheme in Scotland *by Maitland Mackie jnr., Westertown Farm, Aberdeen)*

Westertown Farm lies on a hillside rising from 300-800 ft. a.s.l. and covers 750 acres. Half the farm is in grass, the remainder is arable, mainly producing grain crops to feed the livestock. The chief activity is dairying with some 150 milking cows and 130 heifers being fattened for meat, making a total of about 300 dairy animals in all. Other livestock include 30 sows whose young are fattened for bacon, 2,000 battery hens producing eggs and 17,000 broiler birds.

The milking cows are kept in two houses—the byre and a concrete silage house, which, when full, will hold 2,000 tons of grass silage for their winter feed. They move from their bed of half-chopped straw to the mangers, the milking room or to the face of the silage clamp and back on a slatted runway of reinforced concrete bars through which their dung and urine can pass down into an inclined concrete channel. The solid farmyard manure is removed by fork lift and spread over the arable areas.

Similarly, the young heifers and the pigs live in houses with slatted floors made of loose railway sleepers, between which their manure may fall down on to the main floor some 20 in. below with a fall of some 30 in. in 115 ft. At intervals the accumulation is cleaned out and the material flows



PLAN OF ORGANIC IRRIGATION INSTALLATION
Westertown Farm, Aberdeenshire

freely on its way down the slope.

The material from each house with the washings from the silage house passes into a 12-in. glazed porcelain main leading to the slurry tank, which measures 10 ft. x 10 ft. x 70 ft., has a capacity for 45,000 gal. and is covered by a light grille to keep stones, ducks and other foreign matter from getting into the material. The agitator system consists of eight wooden paddles powered by an electric motor; pumping out is effected by a Bucher '150' piston pump through 1,000 yd. of portable 4-in. aluminium piping and is distributed by two Farrow rain guns operating alternately for calculated periods.

The area which is to be irrigated is first cut for silage and is then 'rained' on, the guns being moved from point to point until the whole paddock is covered by 80-ft. circles of liquid manure. About 100 acres are thus covered each year at an all-in capital and construction cost of £3,300 for the whole installation.

Logging and Floating Timber in the U.S.S.R.

A training course in logging mechanisation and floating of timber was held in the U.S.S.R. during June and July for eight Asians holding fellowships from the Food and Agriculture Organisation.

The group of foresters, consisting of two Burmese, three Indians, two Pakistanis and one Indonesian, visited research laboratories, collective forest farms, felling sites, timber yards, industrial plants and floating timber units within the greater Leningrad-Moscow area.

The tour was broken down into a series of interspersed lectures and practical demonstrations. Delegates first spent several days at T.S.N.I.I.M.E. (Central Scientific Research Institute for Mechanisation of Forest Exploitation) and then studied organisation, equipment and methods at two collective farm forests. The group then went to timber-floating laboratories of the Institute for lectures and demonstrations, followed by two weeks spent with a log-floating unit, where it reviewed the entire technical process from tree felling to arrival of the rafts at Leningrad.

A similar training course in arid-zone forestry is planned in the U.S.S.R. in August-September for a group of 16 foresters led by FAO liaison officer Mr. Mogens Andersen. This will consist of visits to research institutes and planning organisations in Moscow, lectures at the All-Union Scientific Research Institute for Agro-Silvicultural Reclamation and visits to shelter belts, ravine afforestation works and erosion control measures around Stalingrad, followed by study of semi-arid forestry in Ukraine, Azerbaidjan and Uzbekistan.

Letter to the Editor

In the February issue, Major G. O. Hughes, of Kenya, put forward a suggestion that a simple tractor was more suitable for more backward countries and he made five recommendations which are here answered point by point.

Sir,—No doubt by now most of the tractor manufacturers will have taken up the challenge in Major Hughes' letter in the February issue of WORLD CROPS, and pointed out the impossibility of automating for equipment that will be 30 years' out of date before manufacture is started.

We have gone into the points raised in some detail at one time or another and thought that your readers might be interested in our findings.

(*a*) Inertia starters have been used quite successfully out here, but they are not cheap. In most cases the owner of a tractor in an underdeveloped area will be a contractor, and to keep up with his orders he may have to plough at night. There is no doubt that the electrical equipment is the weak link in the tractor, but it is certainly not sensitive to rain water on a diesel tractor.

(*b*) If the cost of a trailed plough is compared to the cost of a mounted plough and a hydraulic unit to fit on the tractor, there is very little difference in cost, and for travelling long distances on unmade roads and working in small fields mounted equipment is essential.

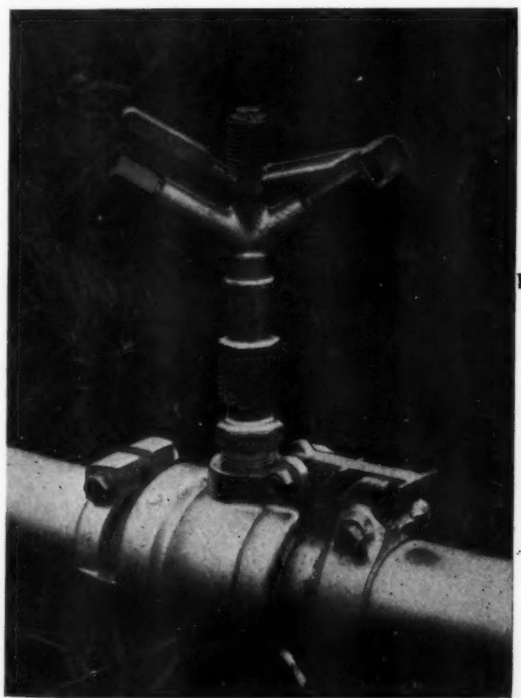
The p.t.-o. is essential for most tractors in Kenya at any rate, as after the relatively short ploughing season they spend all their time milling 'Posho' or maize meal.

(*c*) A fixed wheel setting could be used, but it costs so little more to make it adjustable that it would be foolish not to.

(*d*) Experience with one dry-type air cleaner on a tractor in Kenya has shown that very slight mis-assembly or distortion of the housing is fatal and they were quickly replaced by the old oil-type of cleaner. In dusty conditions any air cleaner will require daily attention, the centrifugal type of separator not being reliable over a wide range of engine speeds.

(*e*) The painting of maintenance points red assumes the tractor will be kept clean, not easy in waterless areas. It is only of advantage on machines with which the greaser is not familiar. Most Africans have extremely good memories and once shown a routine can repeat it perfectly. If they choose to 'forget' to grease, no amount of red paint will help them remember.

I. M. JOHNSON,
Agricultural Research Officer
(Engineering).
Department of Agriculture,
P.O. Box 470,
Nakuru, Kenya.



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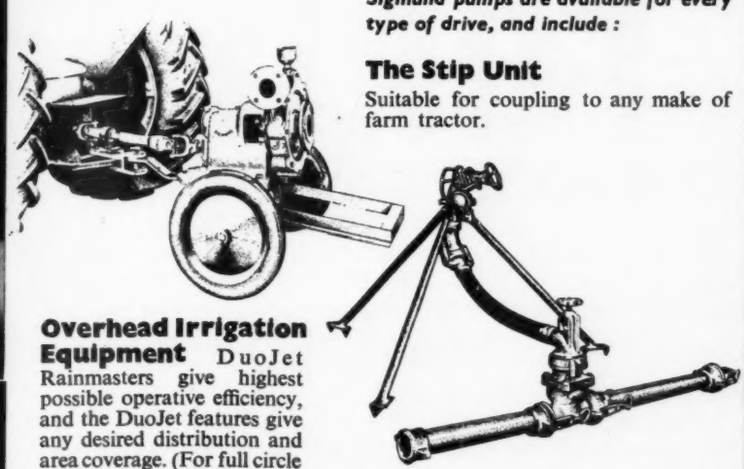

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New Publications

The Mango

By L. B. Singh. Pp. 438. World Crops Books (general editor, Prof. N. Polunin). Leonard Hill (Books) Ltd., London, 1960. Price 84s.

This delectable fruit, so well known throughout the Orient and now grown commercially in many tropical and sub-tropical countries, has received much attention in widely scattered publications. The present book records what is known about the mango, particularly the results of recent research, and since the author is Director of the Horticultural Research Institute, Saharanpur, India, he is well qualified to suggest further research of importance.

The opening chapters provide a lucid account of the history, distribution and botany of the mango tree. It is illuminating to note that in India alone the acreage of mango is nearly 2¼ million acres, of which 1.3 million acres are in Uttar Pradesh (North India) with average production of 3.3 million tons of fruit per annum. A useful map shows the mango regions of the world supplemented by a detailed account of these areas.

A summary is provided of 15 species of Mangifera occurring in S.E. Asia which may prove of service as root stocks for the common mango or provide material for hybridisation. A good account follows drawing attention to the necessity for investigating the use of clonal root stocks, the absence of which has resulted in great variation in mango varieties. Although most trees in commercial orchards are grafted, the seedling stocks are commonly from heterogeneous material.

Polyembryonic varieties, of which few occur in India, may provide a source of clonal root stocks and a list of such varieties and where they are grown is given. Genetical studies are in their infancy and so far a few F_1 hybrids is the only result of work done on the inheritance of characteristics in the mango. A review of current work on hybridisation and the techniques employed will be of value to workers in this field. Attention is given to fruit-bud differentiation and periodicity of cropping, and since the mango is an irregular bearer, some recommendations are made to counter biennial bearing.

The subject of mango varieties receives close attention with useful proposals for classification and emphasis on distinguishing characters. Coloured and plain photographs accompany descriptions of important Indian varieties. The different methods of propagation, commonly employed with tropical fruits, applicable to mango are described and illustrated together with recommendations for stocks and nursery treatment. Field work, including the placing, irrigation, manuring and upkeep of mango groves, is dealt with exhaustively. It is emphasised that there is great need for careful field research, particularly on irrigation, before final recommendations can be made.

Pests and diseases are specially troublesome to both mango tree and fruit. Diagnoses are facilitated by detailed accounts and illustrations of those known with proposals for their eradication and treatment.

Final chapters deal with marketing, chemical composition and utilisation of the fruit. Dr. Singh has written an informative book which is well presented with attractive illustrations.

J. N. MILSUM

Tropical and Sub-Tropical Agriculture

By J. J. Ochse, M. J. Soule, Jun., M. J. Dijkman and C. Wehlburg. Two vols. Pp. 1,446. Illus. New York: Macmillan Co., 1961. Price $35 (New York) or £12 5s. (London).

The first part of this book, covering 368 pages—including 46 pages of selected references—gives general information on climate, soils, soil management, cultural practices, crop improvement, economics and food values of tropical products. The remainder of the first volume and the entire second volume is devoted to the discussion of about 200 crops. The work includes an extensive glossary of botanical and technical terms, an author index, subject index and index of common plant names. Selected references are given at the end of each chapter as an aid to further study on any particular crop. The two volumes include 285 photographs and line drawings and over 100 tables, charts, graphs and maps.

Happy is the author who has at his command nearly 1,500 pages for the development of his subject. However, even this is not an over-generous allotment to cover such a vast canvas as the present subject implies. To do anything like justice to a treatise on tropical and sub-tropical agriculture entails strict if not ruthless editing.

As originally contemplated, the work dealt only with selected horticultural and agronomic subjects, but as the writing progressed it became evident that broader coverage would make the treatise more useful. This change of concept probably accounts for the fact that the work as a whole lacks balance. The authors state that the list of plants which could have been included is almost endless and it was therefore necessary to select partly on the basis of world-wide importance and partly to afford representation to different regions of the tropics and sub-tropics, excluding species of equal importance by reason of space limitations.

Admittedly, it may be difficult to decide whether a certain crop should be included, but the authors might have accorded greater prominence to certain crops which are here treated very briefly at the expense of others of little consequence which they describe in detail. For instance, fruit crops cover nearly 500 pages—one-third of the entire work—yet many are unimportant; cinchona, now largely superseded by synthetic products, is conceded 20 pages, and elementary matter, such as methods of plant propagation, not peculiar to the tropics, is described at great length. On the other hand, the important crops, rice and maize, are given 18 and 16 pages respectively; one looks in vain for information on manioc (tapioca) and vegetables—staple foods of millions of people—while mixed farming is ignored and the incidence and implications of shifting cultivation is inadequately treated.

The avowed purpose of this work was to collect a body of information about selected tropical and sub-

tropical crops and allied subjects in brief yet reasonably comprehensive form. In this the authors are undoubtedly successful. But the book is not sufficiently up to date and fails to draw attention in the list of references to much recent research work, the inclusion of which might have excused many omissions in the text.

D. H. GRIST

Production and Environment

Crop Production and Environment by R. O. Whyte. 2nd edition. Pp. 392, illus. Faber & Faber, London, 1960. Price 63*s*.

The first edition of this book was published in 1946; it is now out of print and exceedingly difficult to obtain. This second edition is virtually a new book, being concerned almost exclusively with developments since 1946. Thus the present edition is actually a companion volume to the first edition.

The author's avowed object in writing this treatise is to review some of the important facts arising from research on growth and reproductive development which have a practical application in agriculture and horticulture. The initial chapters deal with certain aspects of research from which new and important results of wide significance may arise. The aim is to indicate the directions of current research, the nature of experiments and the type of results which are being obtained, and their possible application in practice.

About one-third of the book is devoted to basic research and two-thirds to the greater understanding which is now being gained of the distribution, growth and reproduction, genetical composition and yielding capacity of crop plants throughout the world. An important new chapter is concerned with the equipment in current use for research on this subject.

The startling progress in research of this nature since 1946 is demonstrated by comparing the index of the first edition with that of the second. For instance, auxins and gibberellin were apparently not considered of sufficient importance in 1946, or their significance 14 years ago was inadequately appreciated to warrant inclusion in the index, yet a chapter is devoted to each of these subjects in the second edition.

Indeed, the prominence accorded to all aspects of environment in connection with plant production is evidenced by the tremendous increase in literature on the subject, published during the past decade or so, a growth which is described as almost unmanageable in quantity. From this welter of publications the author has selected over 600 titles to form a bibliography, complementary to his text.

This book is not intended so much for physiologists as for agri-botanists, agronomists, crop ecologists, plant breeders and general biologists. It will undoubtedly prove most acceptable to a wide range of investigators in both tropical and temperate regions, but one imagines that progress in this branch of science is likely to be so rapid—and perhaps so dramatic—as to justify publication of another edition of Dr. Whyte's book in the not too distant future.

D. H. GRIST

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Food Research Institute

The first issue of *Food Research Institute Studies*, published by the Food Research Institute of Stanford University, California, was issued in February 1960. This periodical, to be published thrice annually, will contain articles covering a wide range of subjects in the general field of food and agriculture written by members of the Institute's staff and reflecting their current research interests. Articles will supplement and not replace the books and pamphlets published from time to time by the Institute.

Contents of the first number of *Food Research Institute Studies* are: 'Price Effects of Future Trading', 'Food Crops and the Isoline of Ninety Frost-Free Days in the U.S.A.', 'The Smallholder in Tropical Export-Crop Production' and a discussion on 'Farm Policy'.

The Food Research Institute of Stanford University has established a reputation for the many excellent crop and economic studies published during the past few years. They are all standard works which have been read with great interest and respect. It is certain that this new journal will be a welcome addition to the economic studies published by that Institute.

D. H. GRIST

Annual Reports

Pea Growing Research Organisation Ltd. Annual Report for 1960. Pp. 27. Obtainable from Pea Growing Research Organisation Ltd., Agriculture House, Knightsbridge, London, S.W.1. Price 1*s*. 6*d*., post free.

Agricultural Research Council. Report for the year 1959-60. Pp. 209. Obtainable from H.M. Stationery Office, P.O. Box No. 596, London, S.E.1. Price 9*s*.

Tea Research Station. Annual Report for the year 1959-60. Pp. 40. Obtainable from Tea Research Station of Nyasaland and Rhodesia, P.O. Box 51, Mlanje, Nyasaland. Price not stated.

Mauritius Sugar Industry Research Institute. Annual Report for 1960. Pp. 105 and XXXVIII. Illus. Obtainable from Mauritius Sugar Industry Research Institute, Reduit, Mauritius. Price not stated.

West African Cocoa Research Institute. Annual Report for 1959-60. Pp. 91. Obtainable from West African Cocoa Research Institute, Tafo, Ghana. Price 5*s*.

The Institution of British Agricultural Engineers. Year Book for 1959-60. Pp. 188. Obtainable from the Institution of British Agricultural Engineers, 6 Queen Square, London, W.C.1. Price 5*s*.

World News

Czechoslovakia

Fruit Crop Almost Doubled

The 1960 fruit harvest in Czechoslovakia, and particularly the apple crop, has been so good that 200,000 tons will have been supplied to the market—almost twice the expected quota. About 20,000 tons of apples in excess of the quantity foreseen are being processed and the production of bottled apple juice is to be increased by 50%.

Czechoslovakia now has about 47 million fruit trees, roughly a third of which are apple, and by 1965 the figure should be almost 60 million. Some 21,000 acres of orchards have been planted during the past five years and further planting will contribute to achieving the aim of raising the consumption of fruit per head of population from 57-80 kg. a year.

Colombia

Groundnut Acreage Expands

As part of Colombia's broad plans to increase vegetable oil output, groundnut acreage will be expanded sharply in 1961. An estimated 30,000 acres will be planted to groundnuts in 1961 in contrast with not more than 5,000 acres in 1960.

The Cotton Institute of Colombia is assuming responsibility for the expansion programme and has a large supply of seed groundnuts for distribution. IFA has found that groundnuts grow well in cotton-producing regions and provide a good rotation crop. In anticipation of a larger groundnut crop, 10 mechanical groundnut harvesters have been imported.

India

Tree Seed Campaign

Under the Five-Year Plan large-scale afforestation is being carried out by the State Governments of India on waste lands suitable for planting trees, as well as in blanks in private forests recently taken over by the Government. The tempo of afforestation being high and the lands requiring a tree cover being large, it has not been possible to insist on the use of specially selected seeds.

Mr. Alan Whitehead, nematologist at the East African Agriculture and Forestry Research Organisation, Muguga, Kenya, examines a maize root for eelworm damage

Forest officers are, however, aware of the need for high-quality seed and they have been marking elite trees of important forest species normally used in afforestation. Where elite trees are available in concentrated blocks, seed orchards are also being demarcated.

In one of the central States 42 seed orchards containing 5,337 trees have been laid out; in addition 10,190 scattered elite trees of important timber species have been marked for seed collection.

Iran

Fertiliser Campaign

The Government of Iran is to allocate foreign currency for the purchase of 50,000 tons of fertilisers—twice the total amount during the year just ended. An intensive fertiliser campaign is being undertaken among the farmers in co-operation with FAO and other interested groups. A plan is also being considered by which short-term loans at a low rate of interest will be made available to farmers to enable them to purchase fertilisers and so promote increased fertiliser usage.

East Africa

Nematode Survey

Root-knot nematodes or eelworms can be so serious in parts of this region that there may be as many as 100 billion to the acre. It has been estimated that between 80% and 90% of the crops are affected, and it is not uncommon for as much as a quarter of a crop to be lost.

A systematic survey of Kenya, Tanganyika and Uganda is being carried out to obtain precise information on the incidence of the infestations in different climates and soils, and in particular to determine which crops and common weeds are not affected at all.

The idea is to make it possible to recommend a system of crop alternatives, so that after a vulnerable crop has been planted the ground can be cleaned up by growing a crop which does not attract eelworms. A vulnerable crop can then follow and will remain largely unaffected, as the pest is only able to move through the ground very slowly.

Brazil

Coffee Meal and Fertiliser

The Brazilian Coffee Institute has produced a fertiliser made of coffee meal cake and phosphate. The coffee meal, resulting from the extraction of coffee oil and caffeine from 'expurgo' (sacrifice quota) coffee, is mixed with an equal proportion of phosphate. The new fertiliser mixture is being sold at the plants of the coffee oil crushers in the state of Sao Paulo. Sales in 1961 are expected to be about 40,000 tons.

Bahamas

New Manure Mixture

Successful results are reported from the U.S.A. following sales of a new compound fertiliser produced at Freeport, Grand Bahama Island. The product is a mixture of peat, seaweed from the island's beaches, pulverised limestone and fish meal and is said to contain all the proteins and minerals required by plant life.

Coming Events

Agricultural Economics Extension.—The Ninth International Training Centre on Methods and Programme Planning in Agricultural and Home Economics Extension will take place at Wageningen, The Netherlands, from 12 July-6 August. Details may be obtained from the Director, International Agricultural Centre, 1 Generaal Foulkesweg, Wageningen, The Netherlands.

Irrigation.—An International Course on Irrigation in Sub-tropical Regions will be held at Emek-Hefer, Israel, for six weeks from 1 August. Particulars from: Irrigation Extension Centre, Post HaMidrasha LeHaklaut, Emek-Hefer, Israel.

Pacific Science.—The Tenth Pacific Science Congress of the Pacific Science Association will be held at the Universty of Hawaii, Honolulu, from 21 August-6 September. The meeting is sponsored by the National Academy of Sciences, Washington, D.C., and Bernice P. Bishop Museum with the co-operation of the University of Hawaii. The programme is divided into nine main sections: geophysical sciences; biological sciences; public health and medicinal sciences; agricultural sciences; forestry; conservation; anthropology and social sciences; geography; extension work. Enquiries to: Secretary, Tenth Pacific Science Congress, Bishop Museum, Honolulu 17, Hawaii, U.S.A.

Agricultural Science. — The next meeting of the British Association for the Advancement of Science will be held in Norwich, Norfolk, England, from 30 August-6 September.

Section M—Agriculture—will be be presided over by Sir William Slater, secretary of the Agricultural Research Council. The theme for his presidential address will be the revolution in agriculture. Other papers will deal with future developments in farm organisation, farm mechanisation, including automation on the farm and future developments in livestock husbandry and the future of animal breeding. Overseas visitors are assured of a warm welcome and should write to the Organising Secretary, 18 Adam Street, London, W.C.2.

Industrial Chemistry.—The 33rd International Congress of Industrial Chemistry will be held in Bordeaux from 1-8 October. One of the 23 sections will be devoted to agricultural science and the food industry. Information may be obtained from the Société de Chimie Industrielle, 28 rue Saint-Dominique, Paris VII, France.

Aerosols.—The third International Congress organised by the Federation of European Aerosol Associations will be held from 4-6 October in the Congress House, Lucerne, Switzerland. Further information, including programme and applications forms, are available from the International Aerosol Association, Waisenhausstrasse 2, Zurich 1, Switzerland.

The first International Aerosol Exhibition will be held during the period of the Congress and for a further two days at the Kurst-und-Kongresshaus, Lucerne. Further information may be obtained from A. Wettler, c/o Pluss-Staufer A.G., Oftringen, Switzerland. The exhibition is open to the public and admission is free.

Forest Genetics and Tree Breeding.—To further the aims of the FAO World Seed Campaign, the Forestry Commission will hold a course on forest genetics, tree breeding and seed production at Northerwood House in the New Forest, Hampshire, from 9-13 October. Enquiries to: Chief Education Officer, Forestry Commission, 25 Savile Row, London, W.1.

Timber.—A Timber Fair will be held at Dusseldorf from 20-29 October. Details may be obtained from Nordwestdeutsche Ausstellungs-Gesselschaft m.b.H. (Nowea), Messegelande, Dusseldorf, W. Germany.

Water Treatment. — The second Effluent and Water Treatment Exhibition and Convention will be held in the Seymour Hall, London, from 31 October-3 November. Enquiries to the Exhibition Press Officer, 2 Broad Street Place, London, E.C.2.

Insecticides and Fungicides.—A conference on insecticides and fungicides will be held in Brighton from 7-10 November. The conference is sponsored by the Association of British Manufacturers of Agricultural Chemicals. Further details from A.B.M.A.C., 86 Strand, London, W.C.2

Agricultural Exhibitions

N. Rhodesia.—An Agricultural and Industrial Show will be held in Lusaka from 5-7 August. Particulars from Northern Rhodesia Agricultural Society, P.O. Box 333, Lusaka.

Australia.—An Agricultural and Industrial Exhibition will be held in Brisbane from 10-19 August. Particulars may be obtained from the Royal National Agricultural and Industrial Association, G.P.O. Box 122B, Brisbane, Queensland.

The Royal Agricultural Show is to be held in Perth, Australia, from 29 September-10 October. Details from the Royal Agricultural Society, 239 Adelaide Terrace, Perth.

England.—The Royal Smithfield Show and Agricultural Exhibition will be held at Earls Court, London, from 4-8 December, 1961. Further details may be obtained from the Smithfield Show Joint Committee, S.M.N.T., Forbes House, Halkin Street, London, S.W.1.

Manuscripts Required

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Bamford's new FH40A *forage harvester cutting a crop of grass for silage in Staffordshire*

MACHINERY AND EQUIPMENT at This Year's Royal Show

The premier agricultural show of Britain, which is organised by the Royal Agricultural Society of England, was again held near the ancient university city of Cambridge. This was the 113th since its inception in 1839 during the reign of Queen Victoria.

THIS year there were 550 trade and educational stands occupying two-thirds of the show ground and a demonstration area 16 acres in extent. Ten acres were set aside for mechanised bale-handling demonstrations. There was also a working exhibition of slatted floors for livestock with liquid manure spreading, potato steaming for potato silage, and the production of 'haylage' from cut grass.

The competition for new implements attracted 12 entries—four more than in 1960—with a further five entries deferred for the completion of their tests and farm inspection. The entries accepted for the competition were:

Agriquipment Ltd., hedgecutter and trimmer; *Byron Farm Machinery Ltd.*, 'Bulkveyor'; *Catchpole Engineering Ltd.*, hay conditioner; *Cooch & Sons Ltd.*, onion topper; *County Commercial Cars Ltd.*, diesel tractor; *Gordon Felber & Co. Ltd.*, 'Ideal' Rothery grain cleaner; *Fullwood & Bland Ltd.*, circulation cleaning system; *Gascoignes (Reading) Ltd.*, metering hopper; *Jeffery Engineering Co. Ltd.*, grassland sod seeder; *Thompson & Stammers (Dunmow) Ltd.*, 'Rotaspa' spading machine; *Massey-Ferguson (U.K.) Ltd.*, 'Multipull' hitch; *Vicon Agricultural Machinery Ltd.*, 'Varispreader'.

The deferred entries included:

Barfords of Belton Ltd., bale loader; *Gordon Felber & Co. Ltd.*, 'Ideal' Rothery balevator; *Lundell (G.B.) Ltd.*, 'Snauger'; *Trojan Agricultural Sales*, fertiliser spreader and the 'Cultograder'.

The Silver Medal awards of the Royal Agricultural Society of England for the new implement which, 'in the opinion of the judges, fulfills some purpose for which no machine or appliance has hitherto been available, or else embodies some new or substantially improved principle of working', were won by:

Agriquipment Ltd., 'Lupat' hedgecutter; *Gordon Felber & Co. Ltd.*, 'Ideal' Rothery grain cleaner; *Fullwood & Bland Ltd.*, circulation cleaning system; *Vicon Agricultural Machinery Ltd.*, 'Varispreader'.

The Burke Perpetual Challenge Trophy, awarded to the Silver Medallist of outstanding merit, was won by:

Vicon Agricultural Machinery Ltd.

The following is a necessarily very brief account of some of the exhibits. It is hoped to be able to give a further review in our September issue.

A

The new *Allis-Chalmers* ED-40 tractor made its debut at the Show. It is powered by a 37-h.p. diesel engine and is equipped with high and low range transmission, giving eight forward and two reverse speeds. Its three-point linkage will take both categories of mounted implements; a weight-transfer system has been incorporated and there is also selective depth control.

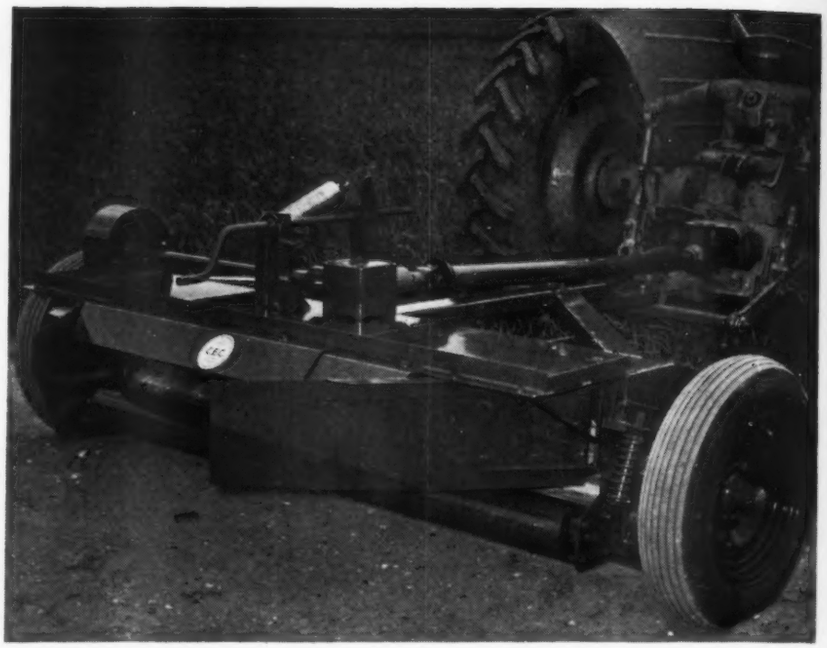
Electrical equipment manufactured by *Associated Electrical Industries Ltd.* is used in many branches of agriculture. They offered the 'Stayrite' electric motor and starter in ratings from 2-15 h.p. and for use with 230-240 v. or 460-480 v. To illustrate these uses there was a display of grain driers, hammer mills and corn crushers, all with an A.E.I. power drive. These included a 5/20 grain drier by *Penny & Porter Ltd.*, a 'Typhoon' crop drier and grain drier by *Modern Appliance & Equipment Ltd.*, automatic hammer mill equipments by *Christy & Norris Ltd.* and *E. H. Bentall Ltd.*, and a *Bracey* conveyor and elevator.

B

The latest addition to the *Bamford* range of farm machinery—the new FH40A forage harvester—will give a 40-in. cut and can be supplied with either a rear-delivery or a swivel chute. The manufacturers announced that this machine would be in regular production by the end of the year.

It is claimed by *Barfords of Belton* that their bale loader can take nine bales to a height of 12 ft. in one lift or load them at the rate of 100 bales in 15 min. They showed this machine, together with their bale sledge, which is hauled behind the baling machine and will stack the bales in piles of six or eight ready for removal by the bale loader. Another machine—the Barford forage harvester—an in-line, flail type, which cuts, lacerates and delivers the crop, can be adjusted to give a height of cut from 1-18 in.

F. W. Berk & Co. Ltd. introduced their new Mk. II seed treater, which has been designed specially for applying their 'Aabiton' and 'Abridin' liquid seed dressings. The grain is passed through an atomised spray in such a way that every single seed is treated; furthermore, there are devices for ensuring that grain cannot pass through the machine in the absence of liquid, that the liquid cannot flow unless grain is passing, and that the machine cannot operate at all unless there is effective air extraction. 'Aabiton' is a fungicide for the control of diseases of wheat, oats, barley, rye, sugar-beet, mangold, flax, brassicas and peas, while 'Abidrin' is applied for the control of wireworm and wheat bulb fly.



This new hay conditioner was shown by the Catchpole Engineering Co. Ltd.

Mechanical hedge cutting

The 'Avon' hydraulic hedgemaker by *Bomford Bros. Ltd.*—a further development of the 'Warwick'—was shown mounted on a *David Brown* '950' tractor. This machine and the manually adjusted 'Arrow' were described on page 201 of our May issue. The company also showed a furrow wheel subsoiler, mounted on a *Massey-Ferguson* '65', intended for use primarily with their two-furrow, anti-choke reversible ploughs. There was also a display of threadless irrigation spray-lines and the 'Hi-Power' oscillator.

'Sta-Dri' cabs were shown as fitted to the *Nuffield* '3', the *International* B.275, the *Fordson* 'Super Major', the *David Brown* '950' and *Massey-Ferguson* tractors. The makers, *Bristol Metal Components Ltd.*, introduced also their new twin cabs for the M-F 702-710 earthmoving equipment. These are made of sheet metal reinforced with angle iron and have safety glass windows; they are both open at the back so that the operator can pass from the tractor to the digger and back.

The *David Brown* display centred round their two standard wheeled tractors—the '950' and the '850' 'Implematic' models. These diesel-powered machines are of 42.5 h.p. and 35 h.p. respectively; features common to both are a six-speed gearbox, hydraulics with depth control, traction control unit and differential lock. The '950' has an exhaust brake which uses the engine power to give even braking when working on sloping land or when hauling heavy loads, and the model shown was also equipped with power steering. Representing their agricultural crawler tractors there was the 40TD model on 46-in. tracks. This is powered by a 42.5-h.p. diesel engine and has a six-speed gearbox. They also showed several of their harvesters, including their recently introduced 'Hurricane' offset harvester, which was described in our July issue.

C

A new hay conditioner, which crimps the grass without shattering or crushing the stems and leaves, and a new down-the-row thinner, called the 'Joice', for thinning out sugar-beet,

cabbages and kale, were introduced by the *Catchpole Engineering Co. Ltd.* They also showed four different types of their sugar-beet harvesters, the 'Lotare' sugar-beet cleaner-loader and their well-known 'cage wheels'.

Caterpillars and wheeled tractors

The centre piece of the *Caterpillar* stand was a group of three British-built D4C tractors—this 65-h.p. model has many agricultural applications. One of these tractors was equipped with the No. 4 toolbar and a 13-tine spring shank cultivator fitted with two rubber-tyred depth gauge wheels. There is also a new swinging drawbar for this tractor for either front- or rear-mounted tools. Two powerful track-type tractors on show were the 93-h.p. D6B and the 235-h.p. D8H; the former was equipped with a No. 6S bulldozer and the latter had a No. 8S bulldozer with hydraulic tilt cylinder and a No. 8 ripper fitted with two teeth. Their 70-h.p. No. 955F 'Traxcavator' carried a log fork and the 80-h.p. wheeled model carried a $1\frac{1}{4}$ cu. yd. bucket.

The design and installation of mechanised feed-ha dling plant is the business of *Colman & Co. (Agricultural) Ltd.* Their equipment includes feed milling, mixing and pelleting machines, silo unloaders, trough feeders and barn cleaners.

Crawler with offset plough

The *County* 'Super 4' is a powerful four-wheel drive tractor based on the *Fordson* 'Super Major'. This revolutionary system is claimed to give maximum wheel grip at all times, so reducing fuel consumption and tyre wear, and giving the best possible service in bad conditions. The steering is power assisted and allows an 18-ft. turning circle, and there are steering brakes which operate on all four wheels.

A crawler tractor with an offset plough attached represents a new development in agricultural mechanisation. Three- and four-furrow ploughs were shown in 10-in., 12-in. and 14-in. widths, for alternative attachment.

D

The centre piece of the stand of the *Dorman Spraying Co. Ltd.* was their sugar-beet band sprayer as fitted to the *Massey-Ferguson* '35' tractor.

They also showed nine types of sprayers from their range; special features noted were the new non-corrosive spray booms and 'no-drift' spray nozzles. Also on display were the 'Stanhay' five-row precision drill and the new 'Gandy' granular applicator.

F

There were 36 tractors on the *Fordson* stand. No fewer than 21 'Dextas' were shown, including the four-wheel drive and narrow track models, as well as the standard agricultural versions, each carrying a different implement; and there were 15

The new 'Lodematic' auto-loader. On receiving the load the platform lifts to a predetermined height; when unloaded it descends and may be wheeled away

'Majors', including the *County* crawler, the *County* 'Super 4' and the *Roadless* four-wheel drive models. There were 22 different FR implements, including the new FR TS 82, two-furrow reversible plough and the new FR TS 78, five-furrow semi-mounted plough. *Ransome's* mounted triple gang mowers and their TS 46D three-furrow 'Multitrac' trailed plough was also shown. The *Howard* 'Rotavator' was to be seen as mounted on the 'Dexta' and the 'Major'.

H

Hayters (Sales) Ltd. were, of course, showing examples of their grass-cutting machinery. The '6/14' trailing grass cutter, which is p.t.-o. driven, gives a cut ranging from 6-14 ft., depending on whether wing extensions are fitted or not. If fitted, the wing extensions can be moved radially, so making it possible to cut close to and around the base of isolated stumps and fruit trees. There was an offset conversion unit which gave a basic offset of 4 ft. 9 in. without wing attachments, and also an interesting new modification to the 24-in. scythe to reduce the risk when the machine is being operated over stony ground. The new 'Mighty Midget' portable welding set, which they showed for the first time, is just the thing for farmers living in remote places.

L

Aid for sack lifting

A useful lifting aid for stacking sacks, for lorry loading and for inter-floor lifting was shown by *Lodematic Ltd.* These handy one-man lifters may be powered either by a small petrol engine or by a mains-powered electric motor; they function automatically after receiving the sack and the platform lifts the sack to any predetermined level up to 12 ft. After the sack has been removed the platform lowers and the machine telescopes and can be pushed to a new position on its two wheels like any ordinary truck.

M

Their full range of tractors and agricultural machinery was displayed by *Massey-Ferguson.* New equipment shown included the '762' chopper—a 60-in. double-chop forager—and a 3-in-1 tractor-digger-shovel earth-moving unit with a new '205' tractor which has, of course, important agricultural applications. Other machines shown for the first time included the '892' combine harvester, the '736' flexiharrow and the '732' rear-mounted mower. The ingenious 'Multipull' hitch, which was first described in our November issue, was entered for the R.A.S.E. Silver Medal award.

The distance between the twin rotating heads of the Stanhay thinner can be varied according to requirements

P

Diesel engines suitable for installation in all types of tractors and combine harvesters were shown by *Perkins Engines Ltd.* The display included three-, four- and six-cylinder models and the 36-h.p. pedestal-mounted 'Three 152' unit, which is designed to power irrigation pumps, hammer and grinding mills, saw benches and a wide range of stationary plant.

R

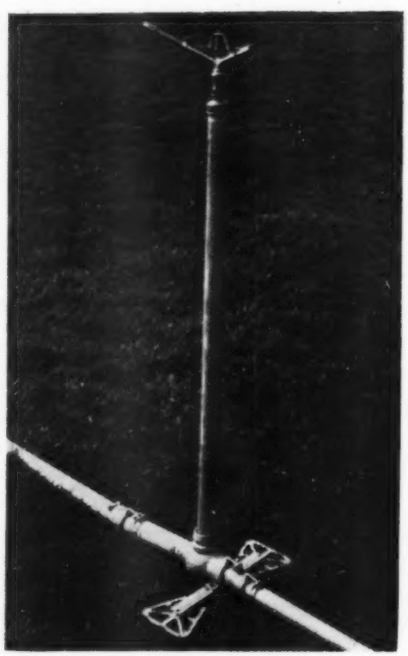
Root Harvesters Ltd. were exhibiting the 'Whitsed' RB harvester with equipment for carrots as well as potatoes and attachments for both bulk loading and bagging-off. The 'Turnhill' root lifter and the new Todd mid-mounted tractor hoe as combined with the Todd down-the-row thinner, fitted to the same *Massey-Ferguson* tractor, enables two operations to be done at the same time. The Todd beet cleaner-loader shown had a large hopper with plenty of cleaning area and space below.

This year *Rotary Hoes Ltd.* introduced some interesting improvements to their products. Both the 'Demon' and the 'Bullfinch' now have *Villiers* engines and the Howard-Clifford '400' has the new JAP '43' engine, although it can also be fitted with the Hirth diesel engine, if so required. The latest version of the 'Gem', too, has a more powerful twin engine. The 'Selectatilth' principle was emphasised on their 50-in. and 60-in. tractor-mounted machines.

S

The principal exhibit of *F. A. Standen & Sons Ltd.* was the improved 'Master Tanker' beet harvester, which now has over-sized ribbed tyres specially designed for operating in wet conditions. It deals with two rows at a time—lifting one row of topped beets, while cutting off the tops of the next row. A following floating flail removes any trash remaining so that the roots are picked up clean.

They also showed their inter-row rotary hoes and the 'Vibro Rota' tiller, which has been described in a previous issue—WORLD CROPS, 1960, **12**, 252.



The 'Master' sprinkler by Wright Rain Ltd. can be fitted with aluminium stabilising pads to give maximum support on rough and uneven ground

Other implements shown were a potato digger and carrot harvester, and a potato haulm cutter and a new dual-wheel coupler.

The *Stanhay* beet thinner, which was first shown at the National Spring Sugar-Beet Demonstration, will, so the makers state, be in full production for the spring of 1962. The device consists of a pair of twin rotating heads which are mounted in tandem and it is powered by the p.t.-o. of the tractor; the final drive is through a rubber 'V' belt which gives smooth, clean action. The distance between the two heads can be altered by two control levers which determine the extent of plant reduction.

The equipment shown on the stand of *Steel Fabricators Ltd.* included the 'Horndraulic' loader, together with its full range of 14 attachments, including manure forks, dirt buckets, fork lifts, bulldozer blades and hedgecutters. They also showed the 'Shawnee' combination unit comprising the Mk. III digger and loader with a Fordson 'Super Major' tractor as the power unit, and there was also the 'Horndraulic' M/C forage harvester, an in-line machine which will give a 60-in. cut.

T

Almost the whole of the stand of *Taskers of Andover* was given over to a static demonstration to show what three of their machines will do—the 'Fertispread', a manure strewer and a muck rake for handling grass and manure. They also had on view their universal trailer and two of their 'Four Seasons' trailers, shown with the extensions for silage and for bulk grain.

W

A feature of the display by *Wright Rain Ltd.* was the emphasis on liquid manuring based on the slatted floor system of housing cattle. Their new H3M 'Manure Rain' pump, which is tractor operated, has a two-way delivery, the smaller branch being suitable for washing yards. For ordinary overhead irrigation they were showing the 'Master' rotary sprinkler—a vertical standard fitted with two stabilising pads to give stability on rough and uneven ground. The 'Vector' sprinkler is a giant rain gun which is suitable also for liquid manuring.

Farm Vehicles

Up and Over

A huge log is no obstacle to the amphibious 'Go-Devil' produced by the *Wagner Tractor Co.*, of U.S.A. Each of the wheels, fitted with enormous *Goodyear* all-weather balloon tyres, is mounted on a leg which can be rotated through 360° and operated individually. In consequence the machine is able to step over obstacles in its path. It can climb 7-ft. banks, wade in shallow streams and cruise in deep water with the aid of a rear-mounted propeller. A longitudinal hinge, connecting both halves of the two-part chassis, enables the machine to turn.

The machine has possibilities for survey and colonisation projects and for farming and forestry in hilly areas.

A huge log proves no obstacle to the amphibious 'Go-Devil'

Lorry Loading

The loading of farm lorries and trailers with crates, sacks and bales can be more speedily and easily done with a mechanical sack loader, but the 'Hipope' mule has the special advantage that it is a self-contained power unit with a 2½-h.p. four-stroke *Villiers* engine which can be transferred from one trailer to another, thereby greatly speeding loading and unloading operations and making the maximum use of the available transport. It also avoids using the powerful engine of the lorry or tractor, so saving engine wear and reducing fuel consumption. The manufacturers, *H. C. Pope Ltd.*, claim that a 7-ton lorry can be loaded in 15 min. with this powerful sack loader.

Effortless loading with the 'Hipope Mule'. The 2½-h.p. Villiers engine, pump and power ram form a complete unit which slides into a cradle on the underside of the lorry or trailer

Useful Lorry Tool

The ingenious 'Zerem' off-set socket wrench, produced by *Eugen Zerver*, of West Germany, has swivel heads so that it is possible to reach bolt heads and nuts in normally inaccessible places on tractors, lorries and tractor-drawn implements. Each wrench will fit eight sizes of nut.

Saving Fuel and Tyre Wear

The power produced by the engine of a motor vehicle has to overcome forces which oppose the motion of the vehicle, even when travelling on level ground. One of these is the resistance caused by the distortion which a tyre undergoes when moving in contact with the road surface. This distortion requires an input of mechanical energy, a certain amount of which is converted into heat and wasted when the tyre resumes its normal shape.

The manufacturers of the *Michelin* 'X' tyre have carried out tests and claim that their new tyre converts less energy into heat than do tyres of ordinary construction. Any saving in energy means a consequent saving in fuel and reduction in tyre wear.

Hay Wain-cum-Tractor

The 'Samecar' is an agricultural tractor which, when required, can be used equally well as a farm vehicle. It is designed to give the tractor driver the same comfort in all weathers as the lorry driver and is so constructed that it can be used for transporting, cultivating and harvesting.

To begin with, the cab has a full-vision tilting windscreen, two removable doors and a large rear window with sliding panels for greater ventilation when required. Conversely, there is a heating unit which will deliver warm air into the cabin in cold weather. In really hot conditions the roof top can be removed by unscrewing four wing nuts.

Left: *The Bonallack 'Pneumarotor' discharging an 8-ton load of pelleted feed into the food store of a broiler house.* Right: *The Samecar tractor being used as a hay wain, the loading elevator being operated from the rear p.t.-o.*

The vehicle can be stripped down and converted into a tractor simply by removing the lorry platform and sideboards and removing the whole of the cabin. Obviously this new Italian introduction will have innumerable uses and applications on farms and plantations.

The 'Samecar' is produced by *Same-F. Cassani & Co.*, of Italy, and not by the company mentioned on page 202 of the May issue.

For Farm and Forest

There is no reason why anyone working in remote places should not be reasonably comfortable today. A mobile home is a real necessity for the land survey prospector, settlement and colonisation officer, forest officer and agricultural advisory official.

This need for personal mobility was emphasised at the 1961 *Morris* Commercial Show at Birmingham, where there were no less than 11 motorised caravans of various designs based on the Morris Commercial V.4 10/12-cwt. and J.2 16/18-cwt. chassis.

Diesel-powered Jeep

The well-known 'Jeep' produced by *Willys Motors Inc.*, of U.S.A., is being offered with a four-cylinder *Perkins* diesel engine as an alternative to their 'Hurricane' petrol engine. While the initial cost of diesel engines is higher there are the advantages of reduced running costs and lower maintenance charges. The advantage is even greater in countries where diesel fuel is cheaper than petrol.

The Perkins 'Four', a 62-h.p. diesel engine, can be fitted to the CJ-5 and the CJ-6 models of the 'Jeep Universal' and the 1-ton 'Jeep' farm truck.

Self-discharging Vehicle

The 'Pneumarotor'—the latest addition to the *Bonallack* range of pneumatic discharge vehicles—has been designed for the bulk transport and rapid discharge of grains and feeding stuffs, including pellets and cubes.

The main feature of the tipping body of this vehicle is the pneumatic discharge equipment and rotary feeder valve, both situated under the body at the rear of the container. The load is removed by air, supplied from a blower mounted on the chassis frame and delivered through a flexible hose to the storage bin. When the container is nearly empty the body is progressively tipped to bring the contents from the forward end to the discharge.

We understand that the special fittings can either be exported or manufactured abroad under licence.

Correction

In our review of land development equipment on page 199 of our May issue it was incorrectly stated that the 'Dinkum' dumper can move loads of 8-10 tons in a day. The caption to the illustration should have read that this machine can carry 10 tons *at a time* and operate continuously on less than 5 gal. of fuel a day.

The diesel version of the 'Jeep Universal' is fitted with a Perkins 'Four' engine developing 62 b.h.p. at 3,000 r.p.m. and has a four-wheel drive

Agricultural Chemicals and Supplies

Anti-Sprouting Fumigator

Trials have recently taken place in Britain of a new Dutch fumigator designed to stop potatoes sprouting when stored in clamps. The method, which is already used widely in Holland, France and Belgium, forces propham and air at high pressure into the clamp.

The spraying equipment is mobile and to provide the necessary air pressure twin compressors are used in parallel. For the recent trials two *Atlas Copco* VT4 portable compressors, each delivering 140 cu. ft./min. at a working pressure of 100 lb./sq. in., were used. The air/powder injections are made into the clamp at the bottom, middle and top, and at 1-yd. intervals. The potatoes should be in the clamp for at least six weeks before treatment to allow for sweating out, and the ideal time for treatment is between December and January.

It is claimed that as a result sprouting is considerably reduced and the growth of badly sprouted tubers is checked. The inventor states that no damage is done to the potatoes and that the powder leaves no smell and does not affect skin colour. Losses through sprouting usually vary from 10-25% of the crop when tubers are untreated.

Mr. J. den Herder, inventor of the anti-sprouting fumigator, shows the effectiveness of the powder jet from the 5-ft. long injection tube

Safe Seed Dressing

A new liquid cereal seed dressing called 'Kotol' has been developed by the *Shell Chemical Co.* which is particularly effective against wireworm and, at the same time, minimises the risk to wild life. It contains lindane (99% BHC) in a non-phytotoxic solvent; used as a seed dressing, lindane is considered to be the insecticide least hazardous to wild life, and the new formulation minimises the risk of phytotoxicity with which BHC has normally been associated in the past. A red dye is incorporated in the product to make for easy recognition of the treated seed.

At present 'Kotol' is not recommended for protection against wheat bulb fly. To control this pest the aldrin-based dressing 'Astex' should be used with 'Panogen' on winter wheat. The seed must be well drilled and spillage on the ground must be avoided to prevent any risk to birds. This risk is also reduced by using the product only in the autumn or early winter and not in the spring.

Without the use of seed dressings the cereal crop yields could be reduced by as much as 30-40% through seed-borne diseases, such as smut and bunt, through damage by wireworm and through attack by wheat bulb fly. With this new product good crop yields can be assured with minimum risk to wild life.

Potatoes in Spain

Chilean natural nitrate of soda is reported to have given consistently higher yields of early potatoes than did sulphate of ammonia in recent irrigated trials in Catalonia and Valencia.

The superior effect of Chilean natural nitrate of soda in these trials is attributed to several factors:

1. The nitrogen in this fertiliser is in the 'nitric' form and so there are no losses from nitrification or ammonia volatilisation. Such losses can be high, especially on calcareous soils.

2. It contains sodium in sufficient quantity to neutralise the acidity of its nitrogen and the acid produced by the nitrification of organic matter in the soil.

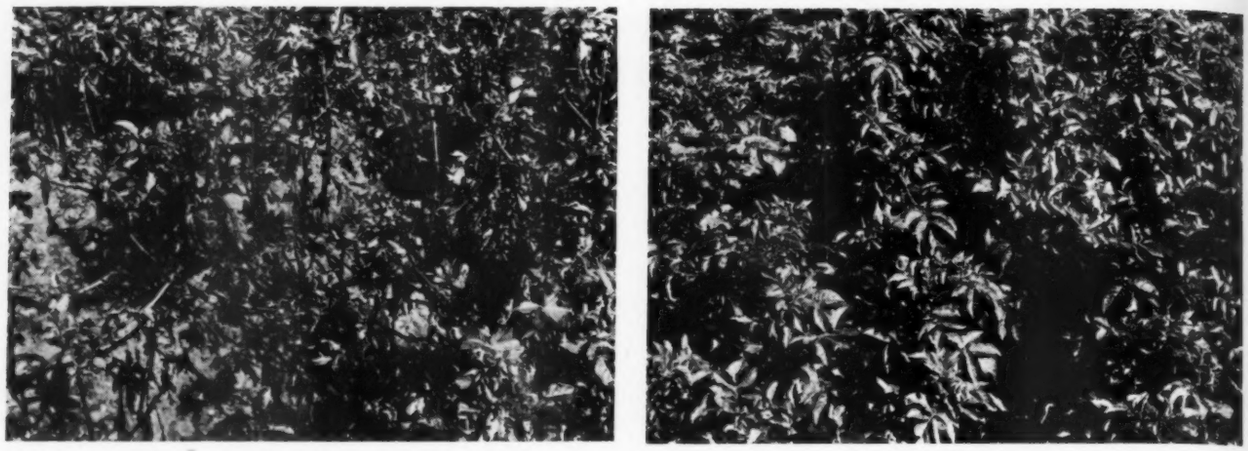
3. Sulphate of ammonia requires 150 lb. $CaCO_3$ per 100 lb. of fertiliser for the neutralisation of the acid it produces, and this results in an equivalent loss of base from the soil. Chilean nitrate, on the contrary, adds base equivalent to 58 lb. $CaCO_3$ per 100 lb. fertiliser.

4. Sodium can partially substitute for potassium within the plant. The Chilean nitrate dressing in the Catalonian trials contained 920 lb. of Na_2O, equivalent to 530 lb. of K_2O per acre, and this made it possible for the muriate of potash in the fertiliser mixture to be halved.

Control of Flies

Fly control in cowsheds, dairies and piggeries is important not only for reasons of hygiene, but also because flies disturb the animals, so reducing milk yields and live weight gains.

'Tugon' fly varnish will destroy the common house flies and biting flies,



Adjoining potato crops used for the trials of the new Boots potato blight spray. Left: *Unsprayed section badly affected by blight.* Right: *A nearby plot showing foliage still clean and healthy as a result of spraying with the chemical control*

even those which have become resistant to chlorinated hydrocarbons, such as DDT. The flies are attracted to the varnish by the presence of sugar in the product and rapidly destroyed; they may even be killed by alighting on the bait without feeding on it. Nevertheless, the material is only of low toxicity to humans and domestic animals.

The product is produced by *Aktieselskabet Agro-Kemi*, of Denmark, and is distributed in the U.K. by *Baywood Chemicals Ltd.*

Control of Potato Blight

Potato blight is the biggest threat to Britain's potato crop and the damage it caused last year was about the worst ever recorded. It is claimed that trials in many parts of the country then showed the effectiveness of a new chemical control introduced by *Boots*.

The active ingredient of the spray is recognised by the Ministry of Agriculture as a non-toxic chemical, but the usual precautions should be taken when handling. To prepare the spray the powder base for the spray should be creamed before being added to the water in the spray tank.

Normally the spray should be applied a day or two before blight may be expected to occur in the area. Crops not 'hilled-up' by then should be sprayed first and then 'hilled-up' later. The second spray should be applied 14-21 days later, according to the growth of the crop and the weather.

If the weather remains warm and humid, the new product should be sprayed at fortnightly intervals until the crop is 'down', but if it is dry and cold the spray is applied at intervals of three weeks. For optimum control a minimum of three sprays is recommended. Finally, the tops are burnt off, either with sodium chlorate or a proprietary potato haulm destroyer.

Pre-emergence Weedkiller

A new approach to weed control in sugar-beets and vegetables is to spray the weeds before they emerge. 'Alipur' —a product of *Badische Anilin- & Soda-Fabrik A.G.*—which incorporates a urea derivate (OMU) and a carbamic acid ester (BIPC), is an emulsifiable concentrate to prevent the germination of a wide range of seedling weeds.

As with other pre-emergence weedkillers, the soil should be clean and free from weeds and clods when sprayed. The object is to establish an active and persistent film of 'Alipur' on the surface which will prevent the emergence of weed seedlings for 6-8 weeks after application. The weedkiller should be applied directly after sowing and the crop seed should be sown as deep as the nature of the soil and the crop permit. Sufficient soil moisture is essential for achieving good results.

According to the manufacturers, extensive field trials have shown that the correct application of 'Alipur' involves no risk for the crop and that a high degree of weed control can be obtained. Official approval of the chemical for weed control in sugar-beets and horticultural crops in Germany, France and Belgium has been obtained.

Insecticide-Miticide

Insects and mites are often a dual problem, each requiring a separate control. One of the most useful features of 'Trithion', by the *Stauffer Chemical Co.*, is that it is both an insecticide and a miticide, acting against a large number of species, including aphids, scale, codling moth and the Mexican bean beetle. It is claimed that 'Trithion' is also highly effective against summer and winter eggs of some mite species, especially the European red mite, thus breaking the life cycle of the mite at a most advantageous point.

'Trithion' gives quick control and has long residual effectiveness with apparently no problem of taint.

The chemical is available in several dust and granular formulations, as well as 'Trithion 25-W' (25% wettable powder) and 'Trithion 4 Flowable' (a 4 lb./gal. aqueous emulsion). It is available in special formulations for specific crops and uses in most areas.

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World Crop Reports

INTERNATIONAL REPORTS

Cotton

World cotton production for 1960-61 is now estimated at 46.9 million bales (500 lb. gross weight), compared with 46.6 million in 1959-60 and an average of 38.8 million for the five years 1950-54. Production this season is again high for the third successive year and continues the increase in world cotton production since World War II.

This higher production was obtained from 80.6 million acres, only a fraction more than in 1959-60 and actually about 2% below the 1950-54 average, showing the trend toward higher yields per acre. The world average yield is 280 lb. per acre this season, well over one-half bale per acre.

Final reports from the *U.S.A.* showed a 1960 crop of 14.3 million bales, compared with the 1959 crop of 14.6 million bales and the 1950-54 average of 14.1 million. The 1960 harvested area was 15.3 million acres, 0.2 million above 1959. Less favourable weather reduced average yield per harvested acre to 446 lb., 15 lb. below 1959 and 20 lb. below the record of 466 lb. in 1958.

Over three-quarters of the increase from last season was in *India* and *Mexico*. Although the second official estimate placed India's acreage at 3% below the corresponding estimate for last year, the crop is now expected to be 4.4 million bales. This is over 1 million bales more than last year's relatively small crop as a result of much more favourable growing conditions. Acreage and production in Mexico were larger in 1960 after a substantial decline in the previous year, but still fell 10% below the high level of 1958-59. The cotton crops were also larger than last season in *Argentina*, *Egypt*, *Syria*, *El Salvador*, *Nigeria*, and several other countries, while harvests were smaller mainly in the *Congo*, *Sudan*, *Turkey*, *Pakistan*, *Italy* and *Spain*.

The total production in other countries, mainly *U.S.S.R.* and *China*, is placed at 14.4 million bales for 1960-61. This is about 1 million bales below that of the two previous seasons, principally as a result of adverse weather.

Reports indicate the 1961-62 acreage now being planted to cotton in a number of Northern Hemisphere countries will be larger than in 1960-61. In addition to generally favourable weather, the prospective increase reflects a continuation of strong demand for cotton in major consuming countries this season, gradually rising prices in world import markets during the last two years and continued government aids to cotton production in many countries.

Groundnuts

World production of groundnuts in 1960 is estimated at 14.8 million short tons (unshelled basis), 4% larger than the previous year's out-turn, but 4% less than the record 15.3 million tons produced in 1958.

The estimated 500,000-ton increase from 1959 is due mainly to larger crops in Nigeria and the area formerly known as French West Africa—largely Senegal, Niger and Mali. Contrary to earlier indications, India's crop in 1960 is estimated unofficially to have been slightly less than in 1959 and China's out-turn may not have varied greatly from a year earlier.

North American groundnut production last year increased 10% from 1959 with substantial expansion in the *U.S.A.* and *Cuba*. Acreage picked and threshed in the U.S.A. was down 3% from 1959, but the average yield per acre was a record 1,259 lb. Production at 886,000 tons was 11% larger than both the previous year and the 10-year (1949-58) average—the result of record yields per acre in South Carolina, Georgia, Florida, Alabama, Oklahoma and Texas.

U.S. groundnut growers intended to plant 1.54 million acres of groundnuts this year—about 2% less than the acreage planted last year and one-fifth below the 10-year (1949-58) average. If the 1955-59 average relationship between planted acreage and picked and threshed acreage prevails, and the average yields by states for the last five years are obtained, production will be about 750,000 tons—15% less than the 1960 crop.

Production in *South America* (harvested early in 1960) declined slightly because of the sharp drop in *Argentine* production. Drought during planting time in Argentina reduced acreage and production to the lowest level since 1955. The 1961 crop, now being harvested, is expected to approximate 237,000 tons or slightly larger than last year's out-turn. Planted acreage was down slightly, but favourable growing conditions are expected to result in higher yields.

Brazil's 1960 groundnut acreage expanded sharply from a year earlier, but because of unfavourable weather production increased only 4%. Production in 1961 is expected to increase about a quarter—to a record out-turn of about 535,000 tons.

A near-record out-turn was harvested in *Africa* in 1960 with unusually good crops in the major producing countries of West Africa. On the basis of estimated commercial purchases the total *Nigerian* crop may approximate 1.3 million tons of unshelled nuts, 13% larger than the reduced output of 1959 and exceeded only by the record 1.4 million tons of 1957. On the same basis total production in *Senegal* may have reached 990,000 tons.

Total production in *Niger* is estimated at 155,000 tons, while *Mali's* crop is estimated at 110,000 tons. These estimates both reflect sharp increases from a year earlier.

With the exceptions of sizable increases in *Sudan* and *Ghana* and a decline in the *Union of South Africa*, 1960 groundnut production in other African countries did not vary greatly from the previous year.

Groundnut production in *Asia* is believed to have been down slightly from 1959. Unofficially, *India's* crop is estimated at 4.8 million tons, some 80,000 tons less than in 1959, despite a 2% expansion in acreage. There has been a notable increase in acreage and production of groundnuts in India in the last decade. However, the increases in production during the period of the First and Second Five-Year Plans (1950-59) fell short of the rapidly expanding demand for this commodity.

Contrary to earlier indications of increased groundnut production in *China*, the crop is now believed to have approximated the 1959 out-turn of an estimated 2.5 million tons. Acreage is believed to have increased about 5%, but weather in 1960 in the major groundnut producing areas, particularly in Shantung, was worse than in 1959, with resulting lower yields.

Indonesia, *Taiwan*, *Thailand* and, to a lesser degree, *Japan* and *Israel* also reported increased groundnut production in 1960. Production in *Burma* and *Australia* declined sharply.

Hard fibres

World production of sisal, abaca and henequen—the three principal hard fibres—in 1960 is estimated at 1,896 million lb. This is an increase of 22 million lb. over 1959 or a third more than the 1951-55 average and nearly two-thirds more than in the five-year period preceding the war.

Production of sisal and henequen increased by 16 and 20 million lb. respectively, but abaca fell by 15 million lb. from 1959. Demand continued strong for all three fibres.

Sisal accounts for about 70% of the total hard fibres, henequen for 18% and abaca for the remaining 12%. *Tanganyika* and *Brazil* produce much of the sisal, with *Kenya*, *Angola*, *Haiti* and *Mozambique* next. *Indonesia* produced about one-third of the total in 1935-39, almost as much as Tanganyika, but has fallen to seventh place with about 2.3% of the world total in 1960.

Abaca (hemp) cultivation is centred in Asia. The *Philippines* furnishes 96% of the world supply with 221.6 million lb. of inspected fibre. There was also an estimated 20.4 million lb. produced and used locally without inspection and government record. Plantations in the principal Central American countries have closed down completely, and *Indonesia* is producing only negligible quantities compared with former years. Henequen is grown mostly in *Mexico*—88% of the total—and *Cuba* ranks second with 7%. Mexican production is at a post-war peak.

REGIONAL REPORTS

Greece

The Greek Governmental Tobacco Committee recently announced that growers will be permitted to plant about 267,000 acres to Oriental-type *tobacco* in 1961. The policy in recent years has been to hold Oriental-type plantings at about 247,000 acres owing to the accumulation of excessive stocks. In 1960, however, plantings were well below that figure, because of unfavourable weather, and the 1960 harvest of about 140 million lb. will not provide quantities adequate to meet foreign and domestic demands.

In recent years, this country has produced both flue-cured and burley tobaccos, the area planted in 1960 to flue-cured being 133 acres and to burley 10 acres. Rapid increases in plantings probably will not occur in the immediate future.

Thailand

Thailand's production of *oil-bearing crops* in 1960 was up 60,000 short tons from the previous year. Although production of each of the principal crops—groundnuts, coconuts, sesame seed, soya beans and castor beans—was larger than in 1959, a sharp expansion in groundnut acreage accounted for 70% of the total increase. This was attributed to an increase in the *maize* acreage, a crop which is usually followed by groundnuts.

Mali

The 1960-61 commercial *groundnut* crop in the Republic is expected to total 57,320 short tons (shelled basis), compared with only 32,715 in 1959-60 and 52,855 in 1958-59.

Improved rainfall conditions—both in amount and incidence—are the main factors responsible for this increased production.

Denmark

Production and consumption of *apple juice* in Denmark have been rising steadily—about 11.6 million quarts were produced in 1960 from approximately 690,000 bushels of apples.

Danish apple growers are interested in expanding the production capacity for apple juice to absorb 1.4-1.8 million bushels of apples, about one-third of Denmark's commercial crop.

India

India's 1960-61 *rice* crop is officially estimated at 8% above the record established in 1959-60.

Production is forecast at 113,300 million lb. of rough rice, compared with 104,100 million in 1959-60. Acreage increased less than 1%—from 82.8 million acres to 83.3 million—but higher yields per acre were obtained in some states.

Gains occurred mainly in the winter harvest. The average yield per acre for the country was 1,390 lb. per acre, compared with 1,245 in 1959-60. The good crop is mainly attributed to favourable weather.

England and Wales

Cereal crops during May were mainly satisfactory, although many were variable due to dry conditions or poor seedbeds. Widespread frosts have caused some damage to potatoes. The germination of root crops was slow but satisfactory. Hay yields per acre were expected to be about, or slightly above, average.

Autumn or winter-sown *wheat* was generally satisfactory, although some crops were rather thin and patchy due mainly to early waterlogging or late sowing in poor seedbeds; growth was retarded by dry conditions in some areas. Autumn- or winter-sown *barley* made steady growth and was generally satisfactory. Spring-sown barley was very variable; some crops looked well, but others, particularly on heavy soils, had been adversely affected by poor soil conditions and were patchy and backward. Widespread yellowing both of barley and wheat was reported. Autumn- or winter-sown *oats* looked promising and spring-sown oats were fairly satisfactory.

Early *potatoes* made rapid growth, but widespread frosts had caused damage to crops and would retard lifting, which had already commenced in some areas. Second early and main-crop varieties were variable. Early-planted crops on the whole had made satisfactory growth, though many crops were patchy due to dry conditions and late planting.

Sugar-beet had germinated well and good progress had been made with singling. The sowing of *mangolds* was delayed by difficult seedbed conditions in some places, but was well advanced in most areas. *Turnips and swedes:* seedbed plantings were progressing well, but the germination of early-sown crops had been slow.

Acknowledgment is made to *For. Crops. & Mark.* for much of the information contained in the above reports.